COMMONWEALTH MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXVIII FEBRUARY 1949

COOK (H. T.). **Control of Sweet Potato scurf by vine cuttings.**—Abs. in *Phytopathology*, xxxviii, 7, p. 568, 1948.

Sweet potatoes severely infected by scurf [*Monilochaetes infuscans* (?) in Virginia] were treated with borax and bedded in sand. The sprouts were pulled from half the bed and vine cuttings (sprouts cut about 1 in. above the sand) taken from the other half. Five two-row (285 ft. long) replications of sprouts and cuttings were alternated in a field occupied by sweet potatoes as lately as 1945. At harvest time the yield of primes per row was 187 and 234 lb. from sprouts and cuttings, respectively, the corresponding percentages of scurf-free primes being 78 and 97, the scurf severity indices 36·7 and 6·1, and the percentages of plants with diseased underground stems 53·7 and 0·2, respectively. These data indicate that infected sprouts were the principal source of scurf and that healthy sweet potatoes may be obtained by planting vine cuttings.

DU PLESSIS (S. J.). **Wingerdsiektes in Suid-Afrika.** [Vine diseases in South Africa.] —221 pp., 70 figs., 1 map, University of Stellenbosch, 1948. 18*s*.

Following an introductory section comprising a tabulated survey of the distribution of vineyards in South Africa (1918 to 1937), the climatic conditions prevailing in the vine-growing districts, and a history of vine diseases in the Dominion, the author summarizes the available information on the symptomatology, etiology, and control of anthracnose (*Elsinoe ampelina*), of which only the conidial state (*Gloeosporium ampelophagum*) is known in South Africa; mildew (*Uncinula necator*), also occurring exclusively in the conidial state (*Oidium tuckeri*); bacterial blight (*Erwinia vitivora*) [*R.A.M.*, xxvii, p. 173]; dead arm (*Phomopsis viticola*) [ibid., xxv, p. 492]; ring spot (*Isariopsis fuckelii*) [ibid., xxiv, pp. 3, 50]; sooty dew (*Exosporium sultanae*) [ibid., xxvii, p. 216]; rotting and spoilage of dessert grapes due to various causes, e.g., grey mould (*Botrytis cinerea*), blue-green moulds (*Penicillium* spp.), black moulds (*Aspergillus* spp.), cobweb mould (*Rhizopus nigricans*) [*R. stolonifer*], and velvet mould (*Cladosporium baccae*) [ibid., x, p. 408; xv, p. 101]; diseases of minor importance associated with infection by *Physalospora obtusa* (Verwoerd & Dippenaar. On the occurrence of a berry wilt and rot of grapes (*Vitis vinifera*) caused by *Sphaeropsis malorum* Berk.—*Sci. Bull. S. Afr. Dep. Agric.* 191, 1930) [cf. *R.A.M.*, xiii, p. 313; xv, p. 726], *C.* sp., *Aureobasidium vitis* var. *tuberculatum* [cf. ibid., ii, p. 152], crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*), *Botryosphaeria ribis* and its var. *chromogena*, apoplexy (also known as Spanish or black measles) [ibid., ii, p. 438], and 'toothache', characterized according to Van der Bijl (Plantsiektes: hul oorsaak en bestryding, 1926) by the stunting and crinkling of the leaves and shoots and the gradual decline of the stems or branches bearing them; these symptoms are closely reminiscent of 'esca' [*Stereum necator* or *Fomes igniarius*: *R.A.M.*, x, p. 221; xvii, p. 12, *et passim*], which is held in some quarters to be identical with apoplexy.

Physalospora obtusa was first observed in the vicinity of Worcester in 1927,

and in 1928–9 it lowered the yield by 25 to 30 per cent., as reported by Verwoerd and Dippenaar [ibid., x, p. 408]. Since then the pathogen has spread to practically all the districts where dessert varieties are cultivated, reducing the grapes to the dimensions of shrivelled raisins, hence the popular name of 'raisin rot'. It also causes die-back of the shoots.

Two serious diseases are of little importance in South Africa, namely, downy mildew (*Plasmopara viticola*) and black rot (*Guignardia bidwellii*), and a number of others are unknown there. Various physiogenic disorders and anomalies are described and a concluding chapter deals with indirect and direct control measures in general. A bibliography of 93 titles is appended.

Baillot D'Estivaux (L.). **Le cuprosulfite de cuivre, anticryptogamique permanent pour la Vigne.** [Copper cuprosulphite, a permanent fungicide for Vines.]—*Rev. Vitic., Paris*, xciv, 5, pp. 143–144, 1948.

This information has already been noted from another source [*R.A.M.*, xxvii, p. 553].

Van der Plank (J. E.). **The relation between the size of fields and the spread of plant disease into them. Part I. Crowd diseases.**—*Emp. J. exp. Agric.*, xvi, 63, pp. 134–142, 1948.

Evidence, drawn from published data, is presented in support of the suggestions that the size of fields affects the amount of disease entering them and that enlarging fields in itself may be made the primary means of controlling some of the more important plant diseases. In this first part the author considers crowd diseases, defined as those which neither spread far nor persist long in the soil. Taking as an example the spread of cucumber mosaic virus to a field of celery [*R.A.M.*, xvi, p. 584] from a surrounding 75-ft. zone of *Commelina nudiflora*, it is shown that the larger the field the relatively less the source of infection. The spread of crowd diseases is greatly retarded by mixed cropping, where the intercrops are immune and by the isolation of fields and plantations. The distances necessary for effective isolation are less in countries with cool maritime climates than in those with continental climates.

Most virus diseases are crowd diseases because their mechanisms of dispersion are ineffective compared with spore-dispersed fungi and they are relatively non-persistent outside the host. Exceptions are those viruses which persist in the soil and those dispersed by man or having vectors which are very active or travel long distances.

The relation between isolation and enlargement of fields is summarized in the theorem, which is thought to be universally true in plant pathology, that if disease entering fields can easily be controlled by isolation, it can also be controlled by making the fields larger and proportionately fewer. Both methods of control are effective only for diseases entering from outside, for those which do not travel far in considerable amounts or multiply very rapidly within the field, and for annual rather than perennial crops. As fields are made larger and correspondingly fewer without change of shape or aspect, the amount of infection entering per acre is approximately inversely proportional to the square root of the area of the fields, an approximation which becomes increasingly accurate as the dimensions of the field become large in relation to the distance over which considerable infection can travel. The theory receives support from the results of the measurements of spread of potato crinkle [virus X+virus A] in Maine [ibid., xxi, p. 499]. The effect of field enlargement on field to field spread depends on the distance and type of spread and no generalizations are possible. It is possible only to predict that the benefit of enlargement is likely to be greater when infection comes from other fields than when it comes from peripheral uncultivated plants.

The benefit of making fields larger and correspondingly fewer is conditional on their remaining homogeneous with respect to disease when they are enlarged. Evidence shows that increase in field size has a negligible effect on multiplication of disease within the field.

D'Oliveira (B.) & D'Oliveira (Maria de L.). **Aspectos actuais do problema dos virus das plantas.** [Topical aspects of the plant virus problem.]—43 pp., 2 graphs, Sociedade Portuguesa de Biologia, 1947.

Recent important contributions to the literature on plant viruses are summarized, discussed, and listed in a five-page bibliography.

Vanderwalle (R.). **Observations et recherches effectuées à la Station de Phytopathologie de l'État pendant l'année 1945.** [Observations and researches carried out at the State Phytopathological Station during the year 1945.]—*Bull. Inst. agron. Gembloux*, xv, 1–4, pp. 130–138, 1946. [Received November, 1948.]

In this report on plant diseases in Belgium in 1945 [cf. *R.A.M.*, xxvii, p. 463] it is stated that no new centre of infection of potato wart disease (*Synchytrium endobioticum*) [ibid., xix, p. 576] was recorded, confirming the view that the disease is steadily declining in Belgium. Early plantings of crucifers were again severely attacked by *Phyllosticta napi* [ibid., xxvii, p. 463]. A few reports were received of *Colletotrichum cliviae* [ibid., xxvii, p. 74] on *Clivia*. *Ascospora beijerinckii* [*Clasterosporium carpophilum*: ibid., xxvii, p. 463] was more prevalent on cherries than in 1946. A few cases were recorded of *Chrysomyxa abietis* [ibid., xxv, p. 19] on *Pinus* and *Picea* spp., while *Armillaria mellea* occurred on *Pinus laricio*, *Keithia thujina* [*Didymascella thujina*: ibid., xxvii, p. 463] on *Thuja lobbii*, and *Phytophthora richardiae* [ibid., vi, p. 380; xxiv, p. 150] on arum [*Zantedeschia aethiopica*].

Sarejanni (J. A.). **Catalogue commenté des champignons rencontrés sur les plantes cultivées en Grèce.** [Annotated list of the fungi encountered on cultivated plants in Greece.]—*Ann. Inst. phytopath. Benaki*, iii, 2, pp. 41–66, 1939. [Received November, 1948.]

The following records, besides some already noticed, are included in this annotated list of fungi on cultivated plants in Greece [cf. *R.A.M.*, xviii, p. 10]. A species of *Phytophthora* isolated from potato and tomato in various districts is provisionally designated *P. imperfecta* n.sp. in the absence of the perfect state [this species was described in 1936 for forms characterized by the true or apparent absence of oospores: ibid., xvi, p. 833 (p. 46 of original)].

Podosphaera leucotricha has been collected on apple leaves and young branches on the island of Euboea, near Thessalonica; *Sclerotinia fructigena* on pears near Thessalonica and apples at Florina (Macedonia) and Kiphissia; and *S. laxa* on almond flowers, fruits, and branches throughout the country, causing heavy damage in the Mirabello province, Crete. *Sphaeropsis malorum* [*Physalospora obtusa*: see above, p. 49] occurs on apricot and cherry branches, apples, and vine tendrils in various localities, being very widespread on the last-named host in Crete, round Corinth, in Macedonia, and elsewhere. Vine tendrils in Corinth are also attacked in the spring by *Guignardia baccae*, which is prevalent all over the country in its imperfect state of *Macrophoma flaccida* [cf. ibid., xv, p. 75].

Deuterophoma citri [*D. tracheiphila*: ibid., xxvii, p. 469] is found on citron in eastern Crete, where it is responsible for serious losses; on lemon in numerous districts, also in a severe form; and on sweet and sour oranges in Peloponnesus, the latter host also being affected on the island of Chios.

Ascochyta rabiei is a very troublesome parasite of chick peas [*Cicer arietinum*: ibid., xiii, p. 612; xiv, p. 215; xv, p. 700; xxi, p. 403, *et passim*] in the vicinity of Lamia and Thebes, in Crete, and elsewhere.

Claviceps purpurea has been found on rye near Larissa. Wheat bunt (*Tilletia caries* and *T. foetens* [*T. foetida*]) is ubiquitous, the former species predominating in the north and the latter in the south, while *Urocystis tritici* occurs on the same host in the Thessalonica district.

SAREJANNI (J. A.). **Liste III des maladies des plantes cultivées et autres de la Grèce.** [List III of the diseases of cultivated and other plants of Greece.]—*Ann. Inst. phytopath. Benaki*, iii, 1, pp. 9–14, 1939. [Received November, 1948.]

The more important records in this third list of Greek plant diseases [*R.A.M.*, xvi, p. 838] have already been noticed from the same author's annotated list [see preceding abstract].

Twenty-first Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1947.—139 pp. [? 1948].

This report [cf. *R.A.M.*, xxvii, p. 221] contains, among others, the following items of phytopathological interest. The results of field and pot experiments covering the last nine years showed that *Ophiobolus graminis*, the causal organism of wheat take-all [ibid., xxvii, p. 559], causes appreciable losses only when the plants are seriously weakened physiologically, owing to unfavourable climatic and soil conditions; many of the latter can, however, be corrected.

Recent work indicates the possibility of developing potato hybrids highly resistant to leaf roll [ibid., xxv, p. 540]. Tomato spotted wilt virus [ibid., xxvii, p. 380] was epidemic again in field crops of potatoes in New South Wales and Victoria. About 30 per cent. of the tubers from infected plants carried the virus and transmitted it to their progeny. Further studies showed that the ring-spot strain is dominant in the virus complex affecting potatoes, the symptoms being primarily those of this strain. Planting delayed until December reduced considerably the incidence of the disease. About half the potato hybrids tested in severely infected fields at Canberra were either immune from or highly resistant to infection. Further work on resistance is planned. Field experiments, in which potato varieties and hybrids resistant to common scab (*Actinomyces scabies*) [ibid., xxvii, p. 193] were tested against Late Carman and Factor, showed that the resistant ones were much less affected (an unnamed Canadian hybrid being especially resistant), but were poorer yielders. Various potato varieties were tested for resistance to *Rhizoctonia* [*Corticium*] *solani* [loc. cit.]. Differences in susceptibility were much less pronounced than for *Actinomyces* scab. About 10 varieties, which were more resistant than the rest, were selected for further tests.

High-yielding tomato hybrids highly resistant to *Fusarium bulbigenum* var. *lycopersici* [ibid., xxvii, p. 454] showed distinct promise in the Mildura district of Victoria, where local varieties fail. The high resistance, amounting almost to immunity, of *Lycopersicon peruvianum* to spotted wilt virus [loc. cit.] has been confirmed, but the difficulty of hybridizing it with commercial varieties led to testing *L. pimpinellifolium* strains for resistance; one strain has shown some promise and further breeding work with it is in progress.

Field experiments carried out at Sydney and Canberra in which the multiple planting method [ibid., xxv, p. 188] was tested for the control of spotted wilt in tomato showed that, in spite of great differences in the incidence of the disease (extremely low at Canberra, controls 100 per cent. infected at Sydney), results were similar. At Sydney bi-weekly spraying with 0·1 per cent. DDT on triple planted plots reduced attack by infecting thrips to a quarter of that on the unsprayed plants. The calculated effect of triple planting was only partially achieved, apparently because the greater mass of foliage in the more densely planted plots attracted the insects. At Canberra spraying normally spaced plants with DDT reduced infection by approximately 50 per cent.

The resistance to *Ascochyta pisi* found in some primitive European peas [ibid., xxii, p. 6] is heritable in crosses with commercial varieties. A project in co-operation with the Victorian Department of Agriculture is in progress to develop a Greenfeast type pea resistant to *A. pisi* [ibid., xxi, p. 438]. Pea varieties partially resistant to powdery mildew [*Erysiphe polygoni*] and downy mildew [*Peronospora pisi*: ibid., xxii, p. 342], which occasionally cause severe losses, have been hybridized with commercial varieties.

Isolates from bean [? *Phaseolus vulgaris*] plants affected with several species of *Fusarium* and *Macrophomina phaseoli* [ibid., xxvii, p. 551] were tested for pathogenicity at high temperatures. Two *Fusarium* species caused significantly more rotting of the stem bases of inoculated plants than was present in the controls, but *M. phaseoli* did not.

The effects of treating *Pinus taeda* with superphosphate in 1939 and 1941 to reduce needle fusion [ibid., xxii, p. 283] have now largely worn off, symptoms are reappearing, extra growth is less marked, and the treatments need renewing. The considerable timber increase resulting from the 3 cwt. per acre applications and also from those of 2½ cwt. ground rock phosphate or 2 cwt. superphosphate applied to *P. caribaea* has made the treatment substantially profitable.

In the section dealing with forest products investigations (pp. 46–57) it is stated that the results of the high-pressure treatment for the preservation of eucalyptus rail sleepers [ibid., xxvii, p. 222] have continued to show promise. The creosote oil preservatives now exclusively used are found to retard mechanical failure in sleepers and to confer lasting protection against decay. The diffusion treatments have not given highly satisfactory results; it is evident that the manipulation of treatment variables (temperature, duration of treatment, type of chemical, solution concentration, and pH) will not produce, economically, results greatly superior to the thoroughly tested 'fluarizing process'.

Botany.—*Rep. Ga Exp. Sta., 1946–7*, pp. 76–85, 16–19 [? 1947].

This report [cf. *R.A.M.*, xxvii, p. 65] contains, *inter alia*, the following items of phytopathological interest. The three major diseases of muscadine grape vines [*Vitis rotundifolia*] in Georgia, bitter rot (*Melanconium fuligineum*) [ibid., xxv, p. 332], black rot [*Guignardia bidwellii*: ibid., xxvi, p. 142], and angular leaf spot [*Mycosphaerella angulata*] were successfully controlled in 1946 and the yields markedly increased by spraying with Bordeaux mixture (4–4–50). Plants which received eight sprays yielded an average of 104 lb. per vine, the unsprayed 61. The less important diseases include ripe rot due to a species of *Macrophoma* [ibid., xx, p. 623] which causes a 'bird's-eye' spot or a soft rot of the berries; the Thomas variety is especially susceptible, while Hunt, Creek, and Yuga are almost immune. The perfect state is a *Botryosphaeria* sp. which is tentatively referred to *B. ribis*. Occasional rots of berries are caused by *Glomerella cingulata* [ibid., xxi, p. 318] and *Pestalotia* sp. An uncommon leaf spot is associated with an *Isariopsis* sp., and appears to be distinct from *Cercospora viticola* on bunch grapes.

Field studies indicated that *Sclerotium rolfsii*, the pathogen responsible for the destructive 'southern blight' on groundnuts [ibid., xxvii, p. 171], was more severe when they followed groundnuts or cotton or an immediately preceding lupin crop, than following maize, small grain, or winter fallow. Examinations of plants at harvest time showed that fungicide dusting checked the disease, yields being considerably increased when fermate, zerlate, or copper-sulphur (in descending order of efficacy) were used.

Leaf spot counts in a comparative test for the control of groundnut leaf spot [*C. arachidicola* and *C. personata*] on Small Spanish in Tift County showed that copper, fermate, and zerlate dusts slightly increased the effectiveness of sulphur. The acre yield increases over the untreated were: fermate-sulphur (20–80) 554 lb.,

zerlate-sulphur (20–80) 506 lb.; copper-sulphur (10–90 at 3·4 and 4·5 per cent. copper) 511 and 483 lb., respectively, and sulphur alone 336 lb. North Carolina Runner, given four applications of copper-sulphur dust, and undusted plants were harvested at weekly intervals from 141 to 170 days after planting. The yield maximum was reached at 148 days, after which the undusted plants lost pods more rapidly than the dusted. Two watermelon selections from progeny of Georgia No. 2×Ice Box and the F_2 generation from Georgia No. 2×Hawksbury under test in the field showed high resistance to wilt [*Fusarium bulbigenum* var. *niveum*: ibid., xxvii, pp. 307, 405].

A greenhouse method of testing cantaloupe seedlings has been evolved. Thirty or more of each strain resulting from S 213×Smith Perfect crosses were inoculated with both mildews [*Pseudoperonospora cubensis* and *Erysiphe cichoracearum*: ibid., xxvii, pp. 66, 308, 311]. Seeds of the most resistant plants were saved, grown to maturity in the greenhouse, and self-pollinated. A few seeds from each were planted in the field and the remainder of the best lots used again in greenhouse tests. So far, strain C 56–25–21–1–1–45 appears to be most resistant. The progeny of two new crosses are being tested by this rapid method in order to secure more complete powdery mildew resistance.

Eleven selected tomato strains, from a cross *L. pimpinellifolium*×*L. esculentum*, resistant to *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*: ibid., xxvii, pp. 120, 356], were grown in soil heavily infested with the causal organism and with *Septoria* [*S. lycopersici*: loc. cit.] in comparison with five commercial varieties and six strains from the Southern Regional Vegetable Breeding Laboratory supposedly resistant to *Septoria* blight. All hybrid strains showed marked resistance to *Fusarium* wilt, but none was fully immune from *Septoria* blight.

No soy-bean variety highly resistant to *Sclerotium rolfsii* has been found, but experiments revealed that the plants tend to become somewhat more resistant with age. The 1947 soy-bean nursery survey in several southern States [ibid., xxvii, p. 6] showed that Burdette strain 19 appeared to be most resistant to frogeye (*C. sojina*) and Ogden was relatively free from the disease except at Baton Rouge. Wildfire [*Pseudomonas tabacum*: loc. cit.], which seems to be increasing in severity each year, was the most destructive soy-bean disease in 1947. Ogden, Dortschsoy strain 2, Palmetto, C–N–S, Cherokee, and Louisiana Green showed the greatest resistance.

Owing to late spring rains vetches suffered from a severe attack of leaf, stem, and pod spotting (*Botrytis cinerea* and *Colletotrichum villosum*) [ibid., xxvii, p. 66], most being killed before they set seed. Again Hungarian [*Vicia pannonica*] and large yellow flowered vetch (*V. grandiflora*) were relatively free from anthracnose. Many blue lupin seedlings were killed by anthracnose [*G. cingulata*; ibid., xxiv, p. 271] during warm, humid weather. In late spring the fungus may attack pods under similar weather conditions and cause serious damage to the seed crop. The occurrence of a leaf-spot on velvet beans [*Stizolobium deeringianum*], caused by *Phyllosticta mucunae*, was for the first time reported from south Georgia.

On pp. 17–19 the new wheat variety Chancellor is reported resistant to rust [*Puccinia graminis*, *P. triticina*] over a number of years; a small quantity was expected to be available for distribution in 1948.

Fawcett (G. L.). **Departamento de Botánica y Fitopatología. Ex Memoria anual del año 1945.** [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1945.]—*Rev. industr. agríc. Tucumán*, xxxvi, 7–9, pp. 159, 165–166, 1946. [Received November, 1948.]

During the period under review the study of sugar-cane smut (*Ustilago scitaminea*) [*R.A.M.*, xxvi, p. 97] was continued. The fungus is unable to utilize starch as a carbon source, a remarkable character in a parasite of sugar-cane. There is, how-

ever, no lack of bacteria to convert starch into sugar, and the pathogen probably avails itself of their activity to obtain the assimilable carbohydrates which it requires. It was experimentally demonstrated that immune varieties of sugar-cane owe their freedom from smut to the physical properties of the bud structure, which preclude infection under natural conditions, and not to any chemical substance in the composition of the plant.

Some sugar-cane varieties have recently been affected by a kind of mosaic causing the development on the leaves of white spots, the centres of which later turn red. It appears to be of the same type as the well-known white spotting of certain canes of Japanese origin, in which, however, the red coloration is absent. The newly observed disease is mostly confined to the old basal leaves, and its effects are not as severe as those of the ordinary sugar-cane mosaic virus. Only one of the varieties affected, moreover, is at all promising, namely, Tuc. 2613. Another disease, responsible for torsion of the shoots and prevention of growth, is more serious than the foregoing but of limited distribution.

DDT was found to be useless for the control of the insect vector [*Frankliniella paucispinosa*] of 'corcova' and 'black pest' [tomato spotted wilt] of tobacco and tomato [ibid., xx, p. 501].

Specimens of orange affected by 'lepra explosiva' [ibid., xxiv, p. 446] were received from Jujuy and Misiones, but so far the disease has not been observed in Tucumán.

Dey (P. K.). **Plant pathology.**—*Adm. Rep. agric. Dep. U.P., 1946–47*, pp. 39–42, 1948.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xxviii, p. 5]. On p. 21 it is stated that sugar-cane red rot [*Physalospora tucumanensis*] was particularly severe in the Captainganj, Boderwar, Deoria, Baitalpur, Sardarnagar, Pharenda, Ghughli, Bijnor, Dhampur, Nagina, Bhojeepura, Jaunpur, Azamgarh, Ghazipur, and Ballia areas. The virulent light-coloured strain of the fungus heavily infected Co. 213, Co. 312, Mamchua, Co. 210, Co. 214, Co. 211, Co. 331, and CoS. 146. A campaign for the control of the disease was conducted in the affected areas and growers were acquainted with the standard control measures by means of leaflets and articles. Setts inoculated with *P. tucumanensis* and placed in water at 52° C. for 20 to 24 minutes gave better germination than those treated for 28 minutes. Smut [*Ustilago scitaminea*] was observed on Co. 300, Co. 313, Co. 513, and Co. 311 in Burhwal, Gauribazar, Jarwal Road, and Faizabad. Red stripe [*Xanthomonas rubrilineans*] and mosaic [virus] were observed on Co. 313, and stinking rot [? *Bacillus pyocyaneus*: ibid., xiv, p. 395: in Bergey's Manual (Sixth Edition) as *Pseudomonas desaiana*] on CoS. 146 in Shahjahanpur.

Losses from wheat rust [? *Puccinia graminis*: ibid., xxviii, p. 12] (p. 25) were particularly severe in the Western and Central United Provinces. At the Government Research Farm, Kanpur, the damage was caused mainly through shrivelled grains [ibid., xxvii, p. 315], the losses varying from 7 per cent. in I.P. 773 to 38 per cent. in I.P. 723. The fact that the barley crop at Kanpur, which matured much earlier than the wheat crop, was scarcely affected by rust supports the view that wheat can escape serious damage provided that early sowing and proper cultural operations are practised.

As a result of the distribution of packets of agrosan G to areas where grain smut of sorghum [*Sphacelotheca sorghi*: ibid., xxvii, p. 18] is common, very little smut infection occurred in these districts. Both ceresan and agrosan G were shown to be capable of controlling smut of *Pennisetum typhoides* [*Tolyposporium penicillariae*: ibid., xxvi, p. 200], artificially induced by infecting the seed with spores.

Mustards suffer severe losses from an *Alternaria* sp. [ibid., xxvii, p. 196], carried in the seed coat, when winter rains are heavy and the weather favours the spread

of the disease. The disease cannot be controlled by seed-dressings or hot-water treatment but considerable resistance was shown by *Brassica juncea*. Yellow sarson [*B. campestris* var. *sarson*] was very susceptible.

By growing pigeon peas with sorghum in soil artificially infected with the pigeon pea wilt organism [*Fusarium udum*: ibid., xxviii, p. 46] incidence was reduced for a second season. NP. 80 proved most resistant to *F. udum* of the varieties tested, showing only 2·3 per cent. infection.

A severe wilt of soy-beans caused by *Rhizoctonia* sp. was discovered in the hills near Bhowali.

Burkholder (W. H.) & Starr (M. P.). **The generic and specific characters of phytopathogenic species of Pseudomonas and Xanthomonas.**—*Phytopathology*, xxxviii, 6, pp. 494–502, 1948.

The descriptions of many of the phytopathogenic bacteria, most of which are now grouped in the genera *Pseudomonas* and *Xanthomonas* [*R.A.M.*, xxvii, p. 512], have offered, apart from differences in pathogenicity, characteristics of use only in identifying the genus. Consequently it is often impossible to determine the species by means of the usual bacteriological procedures. Believing that where there is a difference in pathogenicity there will probably be other demonstrable differences the authors attempt to indicate the cultural and biochemical properties that may be useful in separating the species.

The plant-pathogenic members of the genus *Pseudomonas* are medium-sized rods, Gram-negative, with 1 to 6 polar flagella. They do not produce indole or hydrogen sulphide, but turn milk alkaline, utilize monosaccharides and sucrose only, and are aerobic or facultatively aerobic with optimum temperatures at 27° to 30° C. Most species can utilize asparagine as the sole nitrogen and carbon source. They remain viable on beef-peptone agar for many months, but not on potato dextrose agar.

Members of the genus *Xanthomonas* produce abundant, slimy, yellow growth on sugar-containing media and are aerobic, Gram-negative, small rods, motile with a single polar flagellum. They form hydrogen sulphide but not indole, they peptonize milk usually with the deposition of tyrosine crystals, and they form acid but not gas from a variety of carbohydrates. They are unable to use asparagine as the sole source of nitrogen and carbon. They remain viable on potato dextrose agar but die off on sugar-free beef-peptone agar.

Contrary to the usual belief it was found that the following species were incapable of reducing nitrates to nitrites; *P. cichorii*, *P. coronafaciens*, *P. maculicola*, *P.* [*Bacterium*] *marginata*, *P. mellea*, *P. phaseolicola*, *P. pisi*, *P.* [*Bact.*] *primulae*, *P. ribicola*, *P. ribes*, *P. sesami*, and *P. woodsii*, while *P. striafaciens* and *P. viburni* gave a very weak reaction. Only *P. aceris*, *P. alliicola*, *P. aptata*, *P. barkeri*, *P. caryophylli*, *P. cichorii*, *P. marginata*, *P. mellea*, *P. pisi*, *P. tabacum*, *P. viridi-livida*, and *P. washingtonia* grew in a tartrate medium. The following tyrosinase-positive species produced in an asparagine-glycerine-tyrosine medium a definite brown pigment which often turned olive green on combining with the water-soluble green pigment produced so frequently by members of this group: *P. alliicola*, *P. angulata*, *P. apii*, *P. barkeri*, *P. berberidis*, *P. coronafaciens*, *P. delphinii*, *P. maculicola*, *P. papulans*, *Bact. primulae*, *P. ribicola*, *P. savastanoi* var. *fraxini*, *P. tabacum*, and *P. viridiflava*. *P. pisi*, *P. savastanoi*, *P. sesami*, and *P.* [*Bact.*] *tomato* also produced this coloration but to a lesser extent. *P. berberidis*, *P.* [*X.*] *solanacearum*, *P. viburni*, and *P. woodsii* were inhibited by sodium chloride concentrations as low as 2 per cent. [ibid., xxvi, p. 288].

Reduction of nitrates to nitrites was observed in some isolates of *X. barbareae*, *X. begoniae*, *X. cucurbitae*, *X. lactucae-scariolae*, *X. papavericola*, *X. geranii*, and *X. pelargonii*; *X.* [*Bact.*] *beticola* and *X. rubrilineans* are strong nitrate reducers and probably do not belong to this genus. As only a minority of *X.* species show this

reaction and strain differences are sometimes seen, this test should be used with caution for determinative purposes. The following species, about half of the number tested, liquified sodium ammonium pectate *X. barbarae*, *X. campestris*, *X. carotae*, *X. geranii*, *X. incanae*, *X. lespedezae*, *X. manihotis*, *X. papavericola*, *X. pelargonii*, *X. phaseoli* var. *sojense*, *X. vasculorum*, *X. vesicatoria* from tomato, *X. vesicatoria* var. *raphani*, and *X. vignicola*. Only *X. phaseoli* var. *fuscans*, *X. geranii*, and *X. pelargonii* were characteristically tyrosinase-positive. The intolerance of sodium chloride [loc. cit.] of *X.* species appears stable enough for determinative purposes.

Wyckoff (R. W. G.). **Multiplication of bacteriophage.**—*Nature, Lond.*, clxii, 4121, pp. 649–650, 3 figs., 1948.

The multiplication of the virus-like bacteriophages was demonstrated at the National Institute of Health, Maryland, by electron micrographs, which showed that young bacteria are lysed soon after contacting the particles of bacteriophage. Foci of bacteriophage multiplication were visible as a few dark clumps, which, together with the single newly formed particles, distributed throughout the remains of the bacterial protoplasm, increased after longer incubation until eventually the areas of lysed protoplasm were more or less completely covered by the bacteriophage particles. It is suggested that they increase at the expense of bacterial protoplasm by a process resembling the multiplication of coccoid bacteria. Apparently most of this growth and multiplication occurs in the protoplasmic masses liberated by lysis.

Alcorn (G. B.), Berryman (P. C.), & Parks (R. R.). **Portable cleaners for seed grain.**—*Circ. Calif. agric. Ext. Serv.* 141, 20 pp., 4 figs., 2 diags., 1948.

After indicating the advantages of using clean cereal seed the authors trace the history of seed treatment in California and enumerate the chief points to consider when constructing a portable cleaning and treating assembly. General cleaning methods for cereal seed and those for specific grains and the control of the principal seed-borne diseases in California are described. Details are supplied of four portable cleaners, which have been used in California for many years and recently modernized. Advice on the formation and maintenance of a farm co-operative for seed cleaning is given.

Vallega (J.) & Stillger (G.). **Royas y otros parásitos de los cereales en los valles andino-patagónicos.** [Rusts and other parasites of cereals in the Andean-Patagonian valleys.]—*Rev. Invest. agríc., B. Aires*, i, 4, pp. 269–278, 1947.

The following observations on cereal diseases in the Andean-Patagonian valleys of Argentina were made during the course of visits to these regions in December, 1944, and February to March, 1946. Wheat is subject to infection by *Puccinia glumarum*, *P. triticina*, *P. graminis*, *Tilletia tritici* [*T. caries*], *T. levis* [*T. foetida*], *Erysiphe graminis*, and *Ustilago tritici*; oats by *U. avenae*, *U. levis* [*U. kolleri*], *P. coronata*, *P. graminis*, and *E. graminis*; barley by *P. glumarum* and *U. hordei*; and rye by *P. dispersa*, *P. glumarum*, and *Rhynchosporium secalis* [see below, p. 60].

Of the wheat parasites, *P. glumarum* is undoubtedly the most virulent, and the races present in Argentina and Chile attack such varieties as Eureka F.C.S. and Klein Cometa, which are resistant elsewhere. As in other South American countries, however, Chino 166 is resistant. Next in order of pathogenicity come *T.* spp. Preliminary tests by A. Cercós indicate that Oro and Kanred, among other varieties, are resistant to the local races, and this information provides a basis for a breeding programme. *U. avenae*, *U. kolleri*, and *E. graminis* are the most important pathogens of oats. Victoria and other varieties grown in Argentina are valuable sources of resistance to the smuts, but so far no indication of appreciable resistance to mildew has been found within the species *Avena sativa* or *A. byzantina*.

The part played by the numerous species of *Berberis* growing in the districts surveyed in the formation of new physiologic races of *P. graminis* requires further elucidation, but hitherto none has been observed to harbour the black rust.

The following physiologic races were collected during the tours of inspection: *P.g. tritici* 17, 14, and 15 [*R.A.M.*, xxvi, p. 293 and next abstract], *P. triticina* 15 [ibid., xxvi, p. 294], *P. coronata* 1 (*An. Inst. fitotec. S. Catalina*, ii. pp. 53–84, 1942), and *P.g. avenae* 7. Of the two last-named, the former [*R.A.M.*, xxvi, p. 385] has also been encountered by Vallega in collections from Uruguay, Brazil, and Venezuela, and the latter [loc. cit.] in a sample submitted by D. Volosky from Chile (unpublished studies). An exact determination of the races of *P. glumarum* proved impracticable, but they are obviously very close to 30 and 37, reported by Straib from Chile in 1937 [ibid., xvii, p. 665]. It is apparent from these and other observations that the cereal rusts of Chile and Argentina are largely interchangeable, the Andean-Patagonian valleys linking the two countries in this respect.

Wild forage grasses are very prone to infection by *P.* spp. and afford important assistance in the diffusion of the rusts. In particular, *Hordeum leporinum*, *H. murinum*, *H. chilense*, *H. comosum*, and *H. jubatum* var. *pampeanus* are very susceptible to *P. glumarum*.

Vallega (J.) & Stillger (G.). **Mutación de color en Puccinia graminis tritici.** [Colour mutation in *Puccinia graminis tritici*.]—*Rev. Invest. agríc., B. Aires*, ii, 2, pp. 93–96, 1 pl., 1948.

In a collection of *Puccinia graminis tritici* from Pergamino, Buenos Aires, the uredospores were of two colours, chestnut to reddish and yellowish-orange, the latter mutation apparently resulting from the absence of pigmentation in the epispore [*R.A.M.*, vii, p. 235; xxii, p. 425, *et passim*]. The physiologic race producing the mutants was shown by its effects on the standard differential wheat varieties, with the addition of Rival, Jumillo, and *Triticum timopheevi*, to correspond to 17, which is widespread in the Argentine cereal belt [see preceding abstract].

Andersen (A. L.). **The development of Gibberella zeae headblight of Wheat.**—*Phytopathology*, xxxviii, 8, pp. 595–611, 2 graphs, 1948.

The writer's studies at Camp Detrick, Frederick, Maryland, on the effects of temperature on the growth, sporulation, and spore germination of *Gibberella zeae* [*R.A.M.*, xxviii, p. 14] and those of inoculum dosage, stage of host maturity, air temperature, and air moisture on the development of wheat blight [ibid., xii, p. 620] were carried out with a highly pathogenic culture supplied by Dr. J. J. Christensen from Minnesota [ibid., iii, p. 392].

The growth of the mycelium and germination of the conidia occurred through a temperature range of 4° to 32° C., with an optimum at 28° for the former and at 28° to 32° for the latter process. The most rapid sporulation took place at 28° to 32° on agar media, but on longer incubation more conidia were formed at 32° than at any other temperature. Few conidia developed at or below 16° and none at 36°; those produced at 20° to 24° were mostly quinqueseptate, while biseptate predominated at 32°.

Conidia were formed on infected heads of plants exposed to continuous wetness at temperatures from 15° to 30°, with a maximum at 25° and high production at 20°. At 25° conidia were produced within 24 hours on plants with well-established infection at the moment of exposure to continuous wetness, whereas 72 hours were required for sporulation on plants subjected to this condition from the time of inoculation. An average of 14,000,000 conidia per head was produced in three days after re-exposure of the infected plants and 36,000,000 in six days on plants exposed continuously after inoculation.

The incidence of infection and severity of the disease increased parallel with the

amount of inoculum up to 1,000,000 to 2,000,000 conidia per pot of ten wheat plants. Little infection occurred on wheat heads inoculated before flowering. The order of enhanced susceptibility of the host to the head blight caused by *G. zeae* was from the flowering to the past-flowering stages, followed by a decrease in the late phases of seed development. The optimum temperature for infection and head blight development was 25°. At 15° infection was slight or absent. Its course was more rapid at 30° than at 20°, but after 60 to 72 hours' exposure to continuous wetness the incidence of infection and disease development were about the same at these two latter temperatures.

The critical periods of exposure to continuous wetness for disease severity were from 48 to 60 hours at 20° and 36 to 48 at 25° for plants inoculated after flowering, the periods for those inoculated in the flowering stage being 60 to 72 hours at 20° and 36 to 48 hours at 25°. Symptoms appeared two days after inoculation in plants inoculated while flowering and exposed to continuous wetness for 36 hours at 25°. At 20° and 30°, with the same exposure period, no symptoms developed until six days after inoculation. A dry period of four to eight days following immediately on inoculation or an initial six-hour exposure of inoculated plants to continuous wetness reduced the severity of the disease as compared with that obtained on plants given no intermediate drying period after inoculation.

Lier (O.) & Jørstad (I.). **Forsøk med varmtvannsbehandling mot naken sot på Bygg og Hvete.** [Experiments on the hot-water treatment of loose smut on Barley and Wheat.]—*Tidsskr. norske Landbr.*, liv, pp. 255–276, 1947. [English summary.]

Formerly of little importance in Norway, the loose smuts of barley (*Ustilago nuda*) and wheat (*U. tritici*) have become much more prevalent of recent years, and a tabulated account is given of five years' experiments to determine the most effective method of application of the hot-water treatment for their control. *U. tritici* was eliminated by two hours' immersion of the sacks of wheat seed-grain in water heated to 47° C., while 1½ hours at the same temperature sufficed to destroy *U. nuda* in barley. Soaking in hot ceresan (0·1 per cent.) tended to impair germination more severely than water at the same temperature. After treatment the seed should be washed in cold water and dried by controlled heat. Preliminary treatment of small samples of barley and wheat seed-grain, followed by germination tests, is recommended as a means of determining the likelihood of loss of germinability in individual lots.

Herbert (T. T.) & Middleton (G. K.). **Mosaic of Barley in North Carolina.**—*Plant Dis. Reptr*, xxxii, 10, pp. 435–436, 1948. [Mimeographed.]

A mosaic disease of barley occurred for the first time in North Carolina in a nursery at Statesville in the spring of 1948, probably caused by one or more strains of the wheat mosaic virus [*R.A.M.*, ix, p. 580; xxii, p. 59]. Adjacent wheat was also infected. Sunrise (a Nakano Wase derivative) and some Sunrise hybrids were the most susceptible barley varieties, while Iredell, Hooded 26, Bolivia, and Davidson were resistant.

Barley strains undergoing yield trials and subjected to natural mosaic infection were severely attacked by powdery mildew [*Erysiphe graminis*]. Those resistant to both diseases yielded an average of 52·9 bush. per acre, those susceptible to mildew only yielded 34·1, those susceptible to mosaic only 28·3, while those susceptible to both diseases yielded 14·2 bush. per acre.

Mosaic of barley is not sufficiently widespread to be of great economic importance in North Carolina, but since the susceptible Sunrise is the most common cultivated variety and Nakano Wase is used as a parent, the disease is a potential threat and should be considered in a breeding programme.

Riddle (O. C.) & Suneson (C. A.). **Sources and use of scald resistance in Barley.**—*J. Amer. Soc. Agron.*, xl, 10, pp. 926–928, 1948.

Barley scald (*Rhynchosporium secalis*) [*R.A.M.*, xvii, p. 22] is a destructive disease in California, especially in the northern half of the State. Resistant varieties have been isolated at the University Farm, Davis, from breeding and testing stocks of diverse origin. In 1938 the 28 parents used to make Composite Cross, C.I. 5461, and 356 homozygous selections from this cross were grown. From this group the resistance of three of the parents, viz., Trebi, Algerian, and Wisconsin Winter, was established. Seventeen resistant selections were recovered from the Composite Cross and their resistance subsequently confirmed. One of these, Modoc, was graded as highly resistant from 1938 to 1941, inclusive, weakly resistant in 1942, and resistant in 1943. In 1940 and 1941 a total of 196 F_2 families from barley introductions chosen at random, crossed with Atlas to determine 'combining ability', were grown. Four male parents, Telli, Osiris, Sheba, and Abyssinian, were indicated as sources of resistance, and confirmation of this hypothesis was subsequently obtained.

In breeding for resistance to scald, a good choice was made in 1937 of Turk as a parent for crossing with Atlas. The subsequent back-cross breeding programme, begun in 1939, terminated in 1944 with selection of homozygous resistant F_3 lines, the composite of which (Turk × Atlas [7]), C.I. 7189, was first tested in 1945. Foundation seed of Atlas 46 was released in 1947.

No convincing evidence of biologic specialization of *R. secalis* in California is forthcoming. However, in a letter to the Division of Cereal Crops and Diseases, dated 18th July, 1947, Dr. Maria D. Campi, of the Central Experiment Station, Castelar, Argentina, who had been given seed of 11 of the resistant varieties reported herein, classed as very susceptible Baughn, Winter Tennessee, Caspian, and Marco. By Californian standards this rating does not apply. Turk and the composite C.I. 7189 are ranked as immune in Argentina [cf. next abstract].

Sarasola (J. A.) & Campi (M[aria] D.). **Reacción de algunas Cebadas con respecto a 'Rhynchosporium secalis' en Argentina.** [Reaction of some Barleys in regard to *Rhynchosporium secalis* in Argentina.]—*Rev. Invest. agríc., B. Aires*, i, 4, pp. 243–260, 3 pl., 1947.

Rhynchosporium secalis is an important pathogen of barley in Argentina [see above, p. 57 and preceding abstract], and the present paper is a tabulated survey and discussion of the writers' inoculation experiments on 237 barley varieties and selections and other Gramineae, in the hope of discovering sources of resistance. The inconvenience due to the slow growth of the fungus on potato dextrose agar was obviated by the addition to the cultures of sterilized water (5 to 10 c.c. per flask of 200 c.c. capacity).

Elymus canadensis, *Festuca elatior* var. *arundinacea* [*F. arundinacea*], and *Agropyron smithii* proved to be susceptible to *R. secalis*, while *Bromus unioloides* was mildly attacked. Wheat, oats, rye, and a number of other grasses were immune. Among the most promising of the barley varieties tested were Forrajera [fodder] R.M. 85, Psaknon C.I. 6305, Forrajera de Invierno [winter fodder], Horn × Sandrel 5028, Trebi selection Klein, Trebi C.I. 936, Trebi I, Tregal × Primor × Trebi F.C.S., and probably the more recently introduced Osiris C.I. 1622, (Atrada × Atlas) C.I. 7189, Atrada 5611–2, Telli C.I. 194, and Jet C.I. 967, the last-named being the most resistant of the two-rowed varieties included in the trials. Mention may also be made of Field 5916, Tennessee 257, and Cebada 97 A.C.I. 6352 as valuable breeding material.

The Argentine collections of *R. secalis* yielded at least four physiologic races, which were readily distinguishable by their effects on the Wisconsin Winter × Glabron 2073, West China, and Nigrum varieties. Of these, all were resistant to

race 1, Nigrum was susceptible to 2, West China to 3, and Wisconsin Winter × Glabron 2073 to 4.

Avizohar-Hershenson (Zehara) & Plaut (M.). **The inoculation of Rye with Claviceps purpurea as related to environmental conditions.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 181–187, 1947.

Field experiments on the infection of rye by *Claviceps purpurea* [cf. *R.A.M.*, xxvii, p. 558] carried out in Palestine during 1941–5 indicated that in the dry, spring climate of this region infection of rye flowers occurs during nights when the humidity is adequate. If, however, the temperature is as low as 11° to 12° C. (i.e., approaching the minimum growth temperature for *C. purpurea* as determined in the laboratory) [ibid., x, p. 374], the limited hours of high humidity during the night are insufficient to permit infection. When mean temperatures are higher (perhaps from 14° up), the fungus appears to be able to establish itself in the course of one or more nights. In cooler climates [of other countries], where the rye flowering period coincides with rain and mist, the nights are probably too cold to allow infection, but the day temperatures in humid weather are suitable. The authors' experiments confirm Lewis's view that infection of rye does not depend on rain [ibid., xxiv, p. 408], but can occur on bright days; the relative humidity rather than rain appears to be the decisive factor.

No natural infections of rye by *C. purpurea* have ever been observed in Palestine. In eight inoculation experiments involving 380 ears carried out by the writers during the six years, six succeeded (total 134 ears infected). Bagging the ears had little effect on the result of the inoculations. Secondary infection of uninoculated ears occurred in 1944. In Palestine, infection can take place only at night, as the daylight hours are too dry. High temperatures during the day (up to 42°) or even two or three consecutive dry days and nights, when the khamsin (hot southerly wind March to May) is blowing, two days after inoculation did not prevent a successful result.

Meneghini (M.) & Silberschmidt (K.). **Contribuição para conhecimento do metabolismo do nitrogênio em Laranjeiras atacadas pela 'tristeza'.** [Contribution to the knowledge of nitrogen metabolism in Oranges affected by 'tristeza'.]—*Rev. Agric. Piracicaba*, xxiv, 5–6, pp. 139–176, 1 fig., 1948. [English summary.]

A tabulated survey is given of nitrogen analyses made at the Biological Institute, São Paulo, Brazil, from August, 1944, to November, 1945, of the bark of healthy and 'tristeza' (root rot)-diseased orange trees [*R.A.M.*, xxvii, p. 564] from the Limeira Experiment Station. The material was taken both from the Baianhina sweet orange scions and the sour orange stocks on which they were grafted.

The nitrogen content of the scions of diseased trees was commonly higher than that of the stock, but in no case was the difference sufficient to postulate an actual accumulation of nitrogenous substances above the graft zone. The nitrogen content of the diseased trees, especially of the stocks, was significantly lower than that of healthy ones. The water content of trees suffering from 'tristeza' was significantly higher than that of healthy ones, and whereas the water content of the two graft components of healthy trees was approximately equal, it was higher in the stocks than in the scions of diseased ones. Thus, the passage of the transpiration flow from the stocks to the scions of diseased trees would appear to be obstructed to some extent.

These observations are discussed in the light of metabolic phenomena associated with virus infection and food translocation in heteroplastic grafts. A bibliography of 35 titles is appended.

Alstatt (G. E.), McLain (R. L.), & Stout (G. L.). **A second report on state-wide surveys for quick decline of Orange trees in California.**—*Bull. Dep. Agric. Calif.*, xxxvii, 3, pp. 168–175, 1948.

This is a complete report of the second state-wide survey of orange plantings in California for new cases of quick decline, the results of which up to 30th June, 1947, have already been noted [*R.A.M.*, xxvii, p. 465]. Additional techniques used in diagnosing new cases included more extensive use of the chemical tests for rootstock identification [ibid., xxiv, p. 312], histological study of the phloem tissue [ibid., xxvi, p. 241], and grafting tests [ibid., xxvi, p. 242; xxvii, p. 519]. Gradual spread is taking place to the east in San Bernardino County and to the south in Orange County.

The revised Quarantine Regulation No. 8, prohibiting the movement of sweet orange trees and propagative parts thereof as from January, 1947 [ibid., xxvii, p. 96], was amended in April, 1947, to permit free movement of host material within infected areas and to modify the conditions under which permits and certificates could be granted for movement from any infected region to other parts of the quarantined area. In May, 1948, the quarantine boundaries were extended in Orange County to include in the lightly infected area some territory into which the disease had been gradually spreading. The adjoining non-infected regulated area was also extended to maintain the safety zone.

In June, 1948, the list of restricted hosts was extended to include grapefruit and pomelo (*Citrus paradisi*), mandarin and tangerine (*C. reticulata*), tangelo (*C. paradisi*×*C. reticulata*), and tangor (*C. sinensis*×*C. reticulata*).

Martin (J. P.). **Effect of fumigation, fertilization, and various other soil treatments on growth of Orange seedlings in old Citrus soils.**—*Soil Sci.*, lxvi, 4, pp. 273–288, 2 figs., 1948.

In view of the increasing interest in the problems involved in replanting old citrus orchards, investigations were undertaken at the California Citrus Experiment Station to ascertain whether reduced growth could be demonstrated with citrus seedlings grown in old citrus soils in the greenhouse, and if so, to determine possible causes and methods of control. This tabulated report presents the results of three years of such experiments, 1945 to 1947 [*R.A.M.*, xxvii, p. 519].

Sour and sweet orange seedlings grown in 3-gal. pots made about 50 to 175 per cent. more growth in non-citrus than in old citrus soils from adjacent areas which had supported citrus trees for 40 to 70 years. Seedlings in the former soils did not respond to applications of phosphorus, potassium, magnesium, copper, boron, zinc, or manganese.

Soil fumigation prior to planting usually controlled root rot (*Fusarium* sp. and other fungi) and the citrus root nematode (*Tylenchulus semipenetrans*) and markedly stimulated seedling growth in old citrus soil, the best results being given by D-D (8 ml. per pot), carbon disulphide (12 ml.), ethylene dichloride (20 ml.), and chloropicrin (4 ml.). In most non-citrus soils growth was only slightly increased or decreased by fumigation. The inoculation of non-citrus soil with water extracts of old citrus soil did not reduce seedling growth or result in the establishment of the root nematode or of the fungus population of the old soil during a nine-monthly growing period. It would thus appear that microbial factors are only partly responsible for the reduced growth of second or third citrus plantings in old orchards.

Mallamaire (A.). **La gommose parasitaire des Agrumes.** [Parasitic gummosis of Citrus].—*Agron. trop.*, iii, 9–10, pp. 489–496, 4 figs., 1948.

In this paper are described the symptoms, development, and propagation of citrus gummosis (*Phytophthora citrophthora* and *P. parasitica*) [*R.A.M.*, xxvi,

p. 12; xxvii, p. 129] together with the varietal reaction, importance of the damage caused, and the methods of control and cure. The disease is known in Senegal, French Sudan, Haute-Volta, northern Dahomey, northern Guinea, Nigeria, and in the Antilles (Guadeloupe, Martinique, and Trinidad). Recently, diseased specimens have been received from Casamance, Senegal, and Fouta-Djalon, French Guinea, where not inconsiderable damage is caused.

Reichert (I.) & Palti (J.). **The control of lichens in Citrus groves.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 222–224, 1 fig., 1947.

After stating that the lichen most prevalent on citrus trees in Palestine is *Xanthoria parietina*, the authors describe a preliminary spraying test carried out on small Shamouti orange trees on sweet lime stock with a combined treatment designed for the simultaneous control of lichens, insect infestation, and fungal diseases such as *Diplodia natalensis* and *Phytophthora* spp. The treatments applied were (*a*) none, (*b*) perenox $\frac{1}{3}$ per cent., 16 l. per tree, (*c*) perenox $\frac{1}{6}$ per cent., 30 l., (*d*) perenox $\frac{1}{6}$ per cent. + white oil 1·75 per cent., 30 l., and (*e*) white oil 1·75 per cent., 30 l. On an arbitrary scale of marking, from 0 representing a normal, healthy growth of lichen to 8, lichen with thallus dark, dry, and peeling off, these treatments received, respectively, 0, 5·4, 6·7, 7·4, and 0·7 average marks. In this experiment only the effect of the treatments on lichen growth was considered.

Littauer (F.), Nadel-Schiffmann (Mina), & Minz (G.). **The mode of infection of Shamouti Oranges by Diplodia.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 158–164, 1947.

Under ordinary conditions of storage or shipping, *Diplodia* stem-end rot of oranges [*D. natalensis*: *R.A.M.*, xxvi, p. 449 and next abstracts] begins two to four weeks after picking, evidence that the rot develops mainly from the infected stem-end being supplied by the fact that incidence is much reduced by debuttoning [ibid., ix, p. 777; xii, p. 20; xv, p. 797]. The authors describe experiments carried out in 1938–9, 1939–40, and 1943–4 to determine whether establishment of *D. natalensis* on any part of the stem-end can induce fruit rot and whether it can be induced through the rind.

Inoculations with and without wounding were made on various parts of the stem-end of Shamouti oranges and laterally on the rind. The inoculated fruits were held at 18° to 19° C. and 100 or 80 to 90 per cent. relative humidity. All wound inoculations on different parts of the stem-end gave positive results at both relative humidities, rot developing after one to two months in storage and varying from 10 to 100 per cent. The success of stem-end inoculations without wounding varied considerably, but was more marked at the higher than at the lower humidity. Percentage of rot was higher, also, when inoculation was performed in February or March than in November to January. The amount of rot was greater and its development faster in fruit picked by Harvey clippers than in that picked by ordinary ones. All [wound] inoculations through the rind were successful, most of the fruit rotting in the course of one week and the percentage of rot was higher when the inoculum was applied with a thick needle than with a thin one. Surface inoculations of the rind without wounding were successful only at high humidities, when mash culture inoculum was applied.

Nadel-Schiffmann (Mina), Minz (G.), & Littauer (F.). **Anatomical study of the button and rind of Shamouti Oranges in relation to the mode of infection by Diplodia.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 170–173, 3 figs., 1947.

An anatomical study of the course of penetration of *Diplodia* [*natalensis*] into Shamouti oranges confirmed the results obtained earlier [see preceding abstract]

that the fungus can enter the fruit from any part of the stem-end inoculated without wounding or from the rind inoculated after wounding.

The first stages of penetration could be seen microscopically two days after rind inoculation by wounding, five days after wound inoculation of sepals and fruit bases, and nine days after inoculation of the cut fruit stalk. In these first stages though abundant mycelium was present in the tissues, the inoculated parts remained healthy, the stem being green and fresh and the rind firm and free from discoloration. Spread of mycelium from the inoculated parts of the stem-end was through the entire stem-end into the fruit; in rind inoculations mycelium filled the entire depth of the mesocarp (flavedo and albedo) under the inoculation site and round it.

Littauer (F.). **Control of Diplodia stem-end rot and moulds in Shamouti Oranges with nitrogen trichloride (Decco process).**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 205–218, 1947.

In experiments carried out in Palestine in 1945–6 and 1946–7, nitrogen trichloride gas (the Decco process) [cf. *R.A.M.*, xiv, pp. 163, 628; xx, p. 57; xxvii, p. 313] effectively controlled *Diplodia natalensis* [see preceding abstracts], *Penicillium digitatum*, and *P. italicum* on inoculated (wounded and unwounded) and uninoculated, commercially handled Shamouti oranges. The best results were given by two successive applications at an interval of two days at the rate of 7 mg. gas per cu. ft. of air for six hours. This treatment reduced rotting after five weeks' storage at 18° C. by 80 to 90 per cent. Timing in relation to picking did not materially influence the process, but single applications made one day after picking were less effective than when made two days after. Three days after picking they were almost as effective as two consecutive applications.

Reduction of storage temperature to 15° retarded development of stem-end rots and blue and green moulds in both treated and untreated fruit, but the gas was almost as effective at the lower as at the higher temperature.

The gas (7 mg. per cu. ft. air for six hours) killed the spores and mycelium of *D. natalensis*, *P. digitatum*, *P. italicum*, *Trichoderma* sp., *Colletotrichum gloeosporioides*, *Alternaria* sp., and *Phytophthora citrophthora* on agar plates, though on glass cover slips these fungi were only partly killed and partly retarded in their development. On agar, even 30 minutes' exposure killed the spores and mycelium of *D. natalensis* and *P. digitatum*.

Applications at 7 mg. gas per cu. ft. air did not affect the rind of Shamouti oranges or affected it only very slightly. Repetition of the applications, higher concentrations, and higher storage temperatures appeared to increase incidence and intensity of rind injury. The treated fruit was of good appearance, remained firm, and had a slightly lighter colour and a cleaner surface than untreated fruit.

Dunlap (A. A.). **2,4-D injury to Cotton from airplane dusting of Rice.**—*Phytopathology*, xxxviii, 8, pp. 638–644, 4 figs., 1948.

During the summer of 1947 cotton in the Gulf Coast area of Texas sustained heavy damage, resulting in a total loss of crop over an area of 2,000 acres, from the dusting of adjacent rice fields by aeroplane, during the latter part of May and the first week of June, with herbicidal mixtures containing about 10 per cent. of various salts or esters of 2,4-dichlorophenoxyacetic acid. The injury took the form of foliar and floral distortions, rupture of the stem cortex, and basal swellings. Partial recovery of the affected plants, as shown by the production of normal foliage and fruiting structures, occurred in most fields where favourable conditions for growth prevailed during the rest of the season. Seed collected from such plants, however, germinated only 40 to 60 per cent. and produced seedlings with swollen root tips and other abnormalities. Some measures are proposed for the prevention of

damage to susceptible crops from weed-killers containing 2,4-dichlorophenoxyacetic acid.

Ciccarone (A.). **Un' interessante defogliazione del Cotone.** [An interesting Cotton defoliation.]—*Riv. Agric. subtrop. trop.*, xlii, 7–9, pp. 154–156, 1948.

During October, 1947, *Alternaria macrospora* [*R.A.M.*, xxvi, p. 14] caused severe leaf-shedding of cotton plants in Venezuela, especially of those in which the peduncles were attacked. Damage was especially evident in an indigenous planting. Seedlings of this indigenous cotton and of Coker 100 Wilt Strain 2 were inoculated when about 20 cm. high by puncture or with pieces of the cultured fungus placed on the peduncles. The puncture-inoculated native plants shed their leaves 11 to 12 days after inoculation and those inoculated with pieces of the fungus also showed positive results, but more slowly. The Coker strain proved much more resistant under the conditions of the experiment [ibid., xxvii, p. 472].

Staten (G.) & Cole (J. F.). **The effect of pre-planting irrigation on pathogenicity of Rhizoctonia solani in seedling Cotton.**—*Phytopathology*, xxxviii, 8, pp. 661–664, 1948.

At the New Mexico Agricultural Experiment Station partial control of *Rhizoctonia* [*Corticium*] *solani* on cotton was effected by giving the seed-bed an irrigation three weeks before planting and thereby allowing antagonistic fungi a long incubation period [cf. *R.A.M.*, xx, p. 60]. Thus, in a lightly irrigated double-row bed the mean percentage of post-emergence damping-off was 2·23 compared with 11·69 in a non-irrigated flat bed, the corresponding figures for the heavily irrigated and non-irrigated beds being 4·57 and 14·50, respectively. In a greenhouse experiment, using acid-delinted, ceresan-treated Acala 1517 seeds, the damping-off in field soil with added inoculum (ground, air-dried seedlings killed by the fungus, 2·5 gm. per pot) was reduced from 40·98 to 26·28 per cent. by pre-planting irrigation. These results suggest the partial inhibition of *C. solani* by antagonistic or competitive organisms in soil irrigated before planting.

Some degree of control may be secured in rainfall areas by early seed-bed preparation when soil moisture is present.

Bánhegyi (J.). **A Balaton környékének Laboulbenia-féléi.** [The Laboulbeniales in the vicinity of Lake Balaton.]—*Bot. Közl.*, xli, 1–2, pp. 49–61, 1944. [French summary.]

Of 20 members of the Laboulbeniales [*R.A.M.*, xxvi, p. 153] collected near Lake Balaton from 1940 to 1943, one species is new to science (*Aporomyces szaboi* n.sp.); seven species new to Hungary (including three new to Europe) are listed and notes are given on four rare species.

Crandall (B. S.). **Pellicularia target spot leaf disease of Kenaf and Roselle.**—*Phytopathology*, xxxviii, 6, pp. 503–505, 1 fig., 1948.

In 1947, the leaves of a trial planting of kenaf (*Hibiscus cannabinus*), introduced into the Tingo Maria zone of Peru in 1943, were observed just before harvest-time to bear small, occasionally zonate spots characterized by a red halo. Within a few weeks the infestation was general and towards the end of the wet season (April) the large, zonate spots were present on almost every leaf. On the under side the zonate character was less distinct and the halo almost completely lacking. Characteristically a cobwebby mycelial growth was found 5 to 10 mm. in advance of the necrotic zonate areas. Tissue isolations from advancing margins of the spots uniformly yielded *Rhizoctonia* sp., while on the older portions of the spots, especially against the veins, fructification of *Pellicularia filamentosa* [*Corticium solani*: *R.A.M.*, xxii, p. 372; xxvii, p. 172] was occasionally found.

The disease also attacked a planting of roselle (*H. sabdariffa*) adjacent to nursery beds of *Hevea* rubber already infected with a strain of the fungus [ibid., xxv, p. 79]. Symptoms of the disease on the roselle leaves were almost identical with those on *H. cannabinus*. These diseases have not previously been described either in Peru or elsewhere on these hosts. Web blight of beans [*Phaseolus vulgaris*: ibid., xix, p. 3] caused by the same pathogen also occurred for the first time in this zone. Okra (*H. esculentus*) grown in close proximity to *H. cannabinus* has remained uninfected so far.

Infected leaves of *H. sabdariffa* and rubber induced typical symptoms when placed in contact with young leaves of these hosts but not on *H. cannabinus*. A leaf spot developed on all three hosts when infected material from rubber was used as the source of inoculum. Four leaves each of *H. cannabinus*, *H. sabdariffa*, bean, and rubber were inoculated with mycelial isolates from each host. The *H. cannabinus* isolate successfully produced the disease in all four inoculations on both rubber and *H. cannabinus* and in two of the four on *H. sabdariffa*. The isolates from *H. sabdariffa* and rubber produced the disease only in the original host. The bean isolate induced in the other three hosts typical target spots of a more virulent type than the natural spots. The disease on the present crop of *H. cannabinus* does not appear to have affected fibre production seriously.

Baker (K. F.). **Addendum concerning the binomial Marssonina rosae.**—*Plant Dis. Reptr*, xxxii, 10, p. 448, 1948. [Mimeographed.]

Although a specimen of Fries's *Erysiphe radiosum* dated 1822 was found in the Farlow Herbarium, it is considered that this does not necessitate an alteration in *Marssonina rosae* (Lib.) Lind. [*R.A.M.*, xxvii, p. 475], the binomial for the imperfect state of the rose black spot fungus [*Diplocarpon rosae*], as the name was not accepted in the Systema Mycologicum and is therefore considered invalid.

Rosen (H. R.). **Fungicidal tests for the control of blackspot on roses, 1945–47.**—*Amer. Rose Mag.*, vii, 12, pp. 458–461, 1948.

Fermate rose dust (consisting of 8·75 parts fermate, 84·7 sulphur, and 6·38 inert ingredients), kolotex (90 parts finely ground sulphur and 10 lead arsenate), and a mixture of 2 per cent. phygon, 2 per cent. DDT, 15 per cent. sulphur, and 81 per cent. talc gave roughly comparable results in the control of rose black spot [*Diplocarpon rosae*: cf. *R.A.M.*, xxvi, p. 107] in Arkansas [ibid., xix, p. 540] in 1947. The percentages of infection on the Étoile de Hollande variety in the plots dusted with the three fungicides were 36, 37, and 40, respectively, as against 57 in the untreated. The average numbers of leaflets per plant on Edith Nellie Perkins, which suffered severely from defoliation due primarily to black spot, were 273, 278, and 213 in the plots dusted with the fermate, kolotex, and phygon mixtures, respectively, and 135 in the controls. The phygon–sulphur–DDT mixture caused appreciable damage to the leaflets.

Clark (Lily H.). **Botrytis polyblastis found in California.**—*Plant Dis. Reptr*, xxxii, 10, pp. 445–446, 1948. [Mimeographed.]

In the spring of 1947 flowers of King Alfred daffodils [*Narcissus pseudo-narcissus*] held under humid conditions at the University of California, Los Angeles, were affected by a watery decay caused by *Botrytis* [*Sclerotinia*] *polyblastis*. In the United States the disease has been reported only from Washington [*R.A.M.*, xiii, p. 772; xxvii, p. 134]. The infected blossoms were obtained from a local florist and the origin of the disease could not be determined. Apparently healthy flowers rotted overnight when subjected to warm, humid conditions. Mycelial inoculations reproduced the watery decay of the flowers and caused typical 'fire' symptoms in

the leaves. Even if the disease is established locally, it is not likely to become damaging in California because of the adverse climatic conditions.

Albrecht (W. A.) & Klemme (A. W.). **Root rot of Sweet Clover reduced by soil fertility.**—Reprinted from *Bett. Crops*, 3 pp., 1 fig., [? 1948].

At the University of Missouri sweet clover [*Melilotus* spp.] plots which had received 2 tons limestone plus 425 lb. 20 per cent. superphosphate per acre for eight years showed a moderate amount of root rot of unknown origin [cf. *R.A.M.*, xxii, p. 435], while in those receiving in addition potash root rot was slight. Both treatments, especially the latter, resulted in considerable increase of root and top growth and in increased nitrogen content, compared with the plots which received limestone only, where all the roots except those near the surface were dead.

It is suggested that the weakened root system is a consequence of insufficient fertility and can best be remedied by giving the plants more potash in a more fertile soil.

Burton (G. W.) & Lefebvre (C. L.). **Ergot and sterility in Bahia Grass.**—*Phytopathology*, xxxviii, 7, pp. 556–559, 1 fig., 1948.

Every year since 1938 *Paspalum notatum* has been heavily infected at Tifton, Georgia, by ergot (*Claviceps paspali*) [*R.A.M.*, xxvii, p. 24]. Highly sterile Paraguay × common Bahia grass hybrids were much more extensively ergotized than either parent. A correlation coefficient of −0·86 was obtained between percentage seed set and ergot prevalence in Bahia hybrid progenies varying significantly in fertility. An apomictic progeny of a male sterile mutant produced more than five times as many ergotized florets as a similar progeny of a male fertile sister plant tested in comparison. The development of *C. paspali* on *P. notatum* was shown to be independent of pollination and fertilization. Susceptible florets inoculated and not pollinated produced numerous ergot sclerotia; inoculation 30 minutes after pollination resulted in the production of a few, while none developed when the operation was performed 24 and 48 hours after effective pollination, resulting in fertilization and seed-set, which seems to confer resistance to *C. paspali*.

Evans (H. J.) & Purvis (E. R.). **An instance of manganese deficiency of Alfalfa and Red Clover in New Jersey.**—*J. Amer. Soc. Agron.*, xl, ii, pp. 1047–1048, 1 fig., 1948.

At the New Jersey Agricultural Experiment Station a stunted and chlorotic two-year-old mixed stand of Northwestern lucerne and Cumberland red clover on heavily limed sandy soil was given a top-dressing of manganese sulphate (50 lb. per acre). Under this treatment the intervenal chlorosis began to disappear within three days, and by the end of a week the plants had regained their normal green colour and resumed growth. Harvested 20 days after treatment, the plots receiving manganese yielded 1,531 lb. dry matter compared with 818 lb. from the controls, an increase of 87 per cent.. None of the other soil amendments used in parallel tests resulted in a similar improvement. The striking differences in the iron–manganese ratios of the treated and untreated plants suggest that the symptoms were due to iron toxicity, as demonstrated by the studies of Sauers and Shive (*Plant Physiol.*, xvii, pp. 582–602, 1942), which was corrected by the addition of manganese.

Lathrop (E. H.) & Hilborn (M. T.). **Recent advances in spray practices for Maine Apple orchards.**—*Bull. Me agric. Exp. Sta.* 457, pp. 325–353, 3 figs., 5 graphs, 1948.

New spraying equipment developed in the past few seasons for use in Maine apple orchards [*R.A.M.*, xxvii, p. 529] includes the Ricker-Hill orchard spray rig, in which the easily operated spray gun is mounted on the spray tank and sprays down into

the tree, various other modifications of the Cheney spray rig developed in 1928, the Automatic spraying unit of the Grand Traverse Orchard Supply Company, the Hardie Multi-Nozzle Spray Boom, the Bean spray mast, the Niagara Liqui-duster, and the Todd fog applicator. Considerable research and field experience will be needed for the proper evaluation of these new machines.

In tests carried out at Highmoor Farm during the past few years with the newer organic fungicides [ibid., xxvi, p. 342] phygon, puratized agricultural spray [N5-E], micronized sulphur, fermate sulphur, puratized 806, copper 8-quinolinolate [ibid., xxvi, p. 67], glyoxalidine 'C', glyoxalidine 'B', and fermate all controlled apple scab [*Venturia inaequalis*], giving over 95 per cent. control. Puratized N5-E, the only new fungicide to show promise as an eradicant, causes no visible foliage injury and is the easiest material to mix. Puratized 806, having phenyl mercury formamide as the active ingredient, controlled scab almost as well as puratized N5-E in 1947 and is recommended for trial as an eradicant. A combination of ¾ lb. fermate and 4 to 5 lb. wettable sulphur appears to control scab more efficiently than when either material is used at full strength alone, and 5 per cent. fermate combined with 95 per cent. sulphur dust appears to give better scab control than sulphur dust alone. The glyoxalidines (experimental fungicide 341) came sixth out of ten materials tested for scab control at Highmoor Farm in 1947 [cf. ibid., xxvi, p. 371].

Fitzgibbon (M.). **Phenyl mercuric chloride—its development for Apple and Pear scab control.**—*Fruitgrower*, cv, 2719, pp. 141–142, 1948.

Extensive tests at the East Malling Research Station, in other parts of the British Isles, and in Northern Ireland have shown that phenyl mercuric chloride at concentrations between 0·005 and 0·01 per cent. on a china-clay carrier is as effective as lime-sulphur or Bordeaux in controlling apple and pear scab [*Venturia inaequalis* and *V. pirina*, respectively: *R.A.M.*, xxvii, p. 371]. There have been few reports of injury to the foliage on any of the 100 or so apple and pear varieties comprised in the experiments.

Renouf (L. R.). **Verticillium wilt of Apricots.**—*N.Z. J. Agric.*, lxxvii, 3, p. 284, 1948.

During the past few years, apricot trees in the Alexandra district of New Zealand have been attacked by wilt due to *Verticillium dahliae* [*R.A.M.*, xi, p. 792; xxvi, pp. 230, 330]. There is a yellowing and shedding of the foliage on the lower parts of yearling wood, the most upright-growing wood being the first affected. The tops of the new growths still appear healthy and growth continues, but the wood is discoloured internally, being light brown at the tops and darker lower down. Occasionally, the whole tree is affected. If the disease grows worse, the top foliage wilts, and this is followed by wilting and death of branches. Sometimes, affected branches live on, and in the season after the appearance of infection growth is weak and bare parts are evident. In several orchards infection has steadily increased since the first appearance of the disease in 1945.

In every case of infection, tomatoes had been grown in the ground previously or between the trees after planting. Once the disease is established in an orchard it cannot be eradicated. Where infected trees have to be removed the soil should be left fallow or replanted with trees other than apricots. Apricots should not be planted in land used or previously used for growing tomatoes.

Grasso (V.). **Alcune delle cause del deperimento del Ciliegio in Italia.** [Some of the causes of Cherry wilt in Italy.]—*Nuovo G. bot. ital.*, N.S., lv, 1, pp. 1–34, 25 figs., 1 map, 1948. [French summary.]

A detailed account is given of further studies by the author on a wilt of cherry trees reported from Tuscany in 1945 and since found in many parts of Italy, includ-

ing Forlì, Cesena, Modena, Vignola, Verona, Ascoli Piceno, Bologna, Pistoi, Florence, Benevento, and Arezzo. The foliage which is exposed to the south is affected first, the wilt later spreading over the whole tree. It may succumb in the course of a few seasons, or it may die in the first season of the attack. The branches and twigs of some affected trees exude copious gum; the growth period is usually normal, but in certain instances it begins or ends before or after the normal time. The stocks very often have cracks in the bark and depressed areas in the trunk with a more or less canker-like appearance; they may extend the whole length of the stock, or occur only at the base, near the ground. They vary in size and shape, but are mostly lozenge-shaped and spread up and down. Their inner surfaces show smaller, similar lesions varying from wine or rust-red to brown. In many cases the cracking is not readily apparent, being covered by the bark. These cracks and depressions are most commonly present on trees growing near rivers or on unprotected sites in the open, and they occur only on the part of the trunk which faces south-west.

The evidence so far available appears to indicate that the condition may be due to excessive heat or cold, and insufficient soil humidity.

Control measures recommended include the use of stocks from high altitudes, low grafting, applications of lime to the trunks, removal of affected parts and disinfection of the wounds, surface digging of the soil, and the application of potassium and phosphoric fertilizers. New plantations should not be made on compact soils, and the trees should be grown in the best cultural conditions.

Nichols (C. W.). **The Little Cherry situation in Idaho.**—*Plant Dis. Reptr*, xxxii, 10, pp. 433–434, 1948. [Mimeographed.]

Evidence indicates that there may be two strains of the little cherry virus in Idaho. The affected fruit in the northern part of the State exhibits symptoms similar to those found in Washington [*R.A.M.*, xxvii, p. 285], while in the southern part the pedicels are shorter ($\frac{1}{2}$ in. shorter on the average), the new growth of trees which have been infected for a number of years shows shortening of the internodes resulting in a rosetted appearance, and the leaves have undulated margins.

In a further note (p. 434) the author states that the first survey for the disease was carried out in the summer of 1948. Of 59,173 trees inspected, 901 were found to be infected, the majority being in Gem, Nez Perce, and Payette counties. A programme for the voluntary removal of diseased trees has been initiated.

Demaree (J. B.). **Yellows or xanthosis in Strawberries in eastern United States.**—*Plant Dis. Reptr*, xxxii, 10, pp. 428–432, 1948. [Mimeographed.]

In May, 1948, the author inspected a field of Massey strawberry plants in North Carolina, part of which, set with plants originating from another State, was affected with a virus disease, which he diagnosed as yellows [strawberry yellow edge virus: *R.A.M.*, xxvii, p. 430]. Both mother and runner plants were weak and dwarfed, with small leaves and short petioles, and the stand was thin because of meagre runner production. The yield was less than half of that of the other part of the field, planted with the owner's plants which remained healthy and vigorous. *Capitophorus fragaefolii* [*C. fragariae*], the vector of the disease, was present in the field. A field of Catskill strawberries in Pennsylvania visited by the author in March, 1948, showed similar symptoms.

There is a striking difference between the manifestation of the yellow edge virus in the varieties grown in the eastern States and in the Marshall and Marshall-like varieties [ibid., vii, p. 650] grown west of the Rocky Mountains. Some of the eastern varieties show only dwarfing, some cupping of leaves or intervenal yellowing in addition to dwarfing; and others very little dwarfing but complete, or nearly complete, suppression of stolon production; in some all symptoms may be masked.

The symptoms become accentuated the second year. The affected western varieties, on the other hand, show crinkling, curling, and usually upward cupping of leaves, marginal and intervenal yellowing of leaflets; dwarfing of both petioles and blades, and general stunting. All symptoms may not show at the same time, and all tend to disappear in summer, chlorosis, in particular, being transitory. None of the eastern varieties exhibits the conspicuous yellow edge symptom of Marshall and the Marshall-like varieties (except Catskill, which has Marshall as one parent). Consequently the prevalence and importance of the disease in the eastern States has been overlooked.

The writer has grafted to Marshall a great number of varieties from several eastern States and most of them transmitted the disease to the indicator plant. Of the older varieties, Aroma, Catskill, Dorsett, Dunlap, Howard 17 (Premier), and others were rarely found to be free from yellow edge virus. Newer varieties, such as Fairpeake, Midland, and Maytime, also carried the virus.

For setting new plots growers are advised to use only vigorous plants taken from high-yielding fields and having large, green, smooth leaves with upright petioles, and heavy runner production. Indexing the more desirable varieties with a good indicator is also recommended; plants thus proved to be free from virus should be propagated under supervision in a vector-free area (*C. fragariae* does not appear to be widely distributed in the eastern States) and sent to growers for mass production under State regulations. It is suggested that this work could be best carried out by State Experiment Stations.

Padmanabhan (S. Y.). **A destructive 'helminthosporiose' of Bananas in Bengal.**—*Sci. & Cult.*, xiii, 12, p. 509, 1948.

Towards the end of November, 1945, a three-acre plantation of Agneswar and Amritsagar bananas, at Daltangar, Nadia (Bengal), was devastated by an epiphytotic associated with a *Helminthosporium* sp. Infection generally originated at a point near the leaf margin, where a light brown, 'V'-shaped or broadly lenticular, pale ashen area, surrounded by a bright yellowish zone of dying tissue, expands until it reaches the midrib, whence it spreads downwards into the pseudo-stem which consequently begins to rot. Some of the leaf blades shrivelled up completely, leaving only the bare, decaying midrib. In some plants the midrib was still free from infection and the central spindle of unfolding younger leaves remained healthy, whereas those emerging from the diseased spindles were stunted, stiff, torn, or curved upon themselves. When the writer visited the farm (one of India Collective Farms, Ltd.) in January, 1946, the whole plantation presented a sickly, yellowish aspect, and not one of the nearly 3,000 suckers had escaped attack.

The tri- to quinqueseptate conidiophores of the fungus are dark to light brown, 43 to 138 by 7 to 9 (average 110 by 8) μ, and arise singly or in groups of two to four with two to three apical geniculations. The uni- to sex-, mostly tri- to quinqueseptate, straight, broadly fusoid, or elliptical conidia, with thick, prominent, dark brown walls and green to olivaceous cell contents, measure 29 to 66 by 12 to 17 μ.

The outbreak was promptly controlled by the removal of the foci of infection and two applications of 5–5–50 Bordeaux mixture.

Moreau (C.). **Une pourriture des Ananas de Guinée.** [A rotting of Pineapples from Guinea.]—*Rev. Mycologie, Suppl. colon.*, xiii, 1, pp. 32–34, 1948.

For some months past, 'Cayenne lisse' and 'Baron Rotschild' pineapples grown at Sonfonia, French Guinea, on reaching France have been 10 per cent. completely rotted, 50 per cent. partially so, and nearly all the remainder affected internally. In most cases infection starts near the stem end, but sometimes arises from a lateral wound or from the base of the crown, if this has been cut.

Conidia of *Ceratostomella paradoxa* [*R.A.M.*, xxvii, p. 572] were found on the fruit surfaces, while cultures from different parts of the fruits also gave *Penicillium sulfureum*, *Rhizopus nigricans* [*R. stolonifer*], and *Trichoderma viride*. The rotting appears to be due to an association of fungi, *C. paradoxa* being chiefly responsible.

Control measures [ibid., xxvii, p. 375] include the clean cutting of stems some distance away from the fruit, the wound being cauterized or dipped in a fungicide mixed with paraffin. Care should be taken to avoid wounds. The duration of transport should be reduced to a minimum and if much infection is present [in the plantation] the fruits should be held for a short time directly after harvesting in a closed chamber containing formalin vapour. The Red Spanish variety is that most resistant to the rotting; hybrids between this variety and 'Cayenne lisse' appear to be satisfactory as regards quality.

Valensi (G.). **Recherches sur les bouillies sulfocalciques.** [Studies on lime-sulphur mixtures.]—*Chim. et Industr.*, lix, 5, pp. 440–444, 4 graphs, 1948.

A method for the complete analysis of lime-sulphur mixtures [cf. *R.A.M.*, xv, p. 240] is proposed, involving determinations of four different portions of a 1: 20 dilution. The analytical data include pH at 20° C. (determined by means of the Jouan glass-electrode potentiometer), the oxidation-reduction potential at the same temperature with reference to a normal hydrogen electrode, and the ionic composition expressed in normality. Optimum conditions correspond to a sulphur:calcium oxide ratio of 2, confirming the generally accepted values in the literature. This ratio corresponds to maximum values of monosulphide sulphur, polysulphide sulphur, total sulphur, total calcium, mass of mixture obtained, and a minimum of undesirable thiosulphate.

Burchfield (H. P.) & McNew (G. L.). **The colorimetric determination of 2,3-dichloro-1,4-naphthoquinone on seed.**—*Phytopathology*, xxxviii, 8, pp. 665–669, 1 graph, 1948.

A simple, rapid method of analysing seed for dosage of 2,3-dichloro-1,4-naphthoquinone [*R.A.M.*, xxiii, p. 265], sold commercially as a fungicide under the trade name of phygon, has been developed at the Naugatuck Chemical Division, U.S. Rubber Company, Bethany 15, Connecticut. The chemical is washed from the seed with acetone and treated with 10 per cent. aqueous dimethylamine to produce a red colour [cf. ibid., xxvii, p. 505], the intensity of which is exactly proportional to the quantity of phygon present, so that accurate determinations can be made by measuring the amount of light transmitted. The dosage can be calculated from these data or estimated graphically by plotting the calibration points for known concentrations of the chemical on semi-logarithmic paper and fitting the best straight line. The concentration of fungicide in the final solution can be determined directly from this graph.

Wei (C. T.) & Ling (K. C.). **The effect of 2,4-dichlorophenoxyacetic acid on the spore germination of fungi.**—*Bot. Bull. Acad. sinica*, ii, 4, pp. 275–281, 3 graphs, 1948.

The toxicity of 2,4-dichlorophenoxyacetic acid to *Rhizopus nigricans* [*R. stolonifer*], *Mucor* sp., *Glomerella cingulata*, *Colletotrichum phomoides*, *Aspergillus niger*, *Penicillium italicum*, *Alternaria* sp., *Helminthosporium triseptatum*, *Phoma* sp., *Zythia* sp., and *Ustilago hordei* reached a maximum at the acid range and decreased rapidly above pH 4. The fungi differed in resistance to the hormone but yielded the same type of curve on the plotting of spore germination against the concentration. Conidial germination in *G. cingulata* and *C. phomoides* was entirely prevented by 100 p.p.m. at pH 3·9, whereas *A. niger* tolerated up to 300 p.p.m. The action of concentrated 2,4-dichlorophenoxyacetic acid on spores is fungicidal

rather than fungistatic and is almost instantaneous. In the case of *G. cingulata* mycelial growth and conidial germination are similarly affected by the hormone.

Disease measurement in plant pathology.—*Trans. Brit. mycol. Soc.*, xxxi, 3–4, pp. 343–345, 1948.

Notes are given on three methods of estimating intensity of plant diseases [cf. *R.A.M.*, xxii, p. 365; xxvii, p. 89]. The simplest method is to estimate the percentage infection. For wide surveys this may be the percentage of crops in a district in which a disease occurs, and may be designated *P* (disease prevalence). Or it may be the percentage of plants infected (*I*) in a whole plot, or in random samples. This method is applicable to diseases which do not affect every plant in the crop.

Where the amount of disease is variable on different plants within the crop the figure for *I* may inadequately represent intensity, and it then becomes desirable to assess the amount of disease on each plant, referring to an arbitrary scale. The simplest type of scale is qualitative, e.g., 'healthy', 'slight', 'severe', but there may be disagreement over doubtful cases. In the American 'disease index' method with five grades 1 to 5, where N is the total number of plants and $N1$, $N2$, $N3$, $N4$, and $N5$ the numbers of plants in each grade, then the Disease Index figure

$$(DI) \text{ is } \frac{N1+2N2+3N3+4N4+5N5}{5N} \times 100.$$

Any inaccuracy in placing the observations in the right categories increases the error of the final figure, while another error is introduced if the amounts of disease in the different categories are not proportional to the numbers of the categories.

In the third method direct estimation of the percentage leaf area affected gives figures which may be designated *DM*. This method is particularly appropriate for diseases such as potato blight [*Phytophthora infestans*: loc. cit.]. The personal equation is less serious with this method than with others, and, further, the values for *DM* have a direct biological meaning. Observations on different dates on the same plots or fields in any season can be plotted in a curve, which is generally sigmoid. Furthermore it is an advantage to have one simple uniform method for different diseases. Also, as crop yield depends on the amount of leaf functioning during the season, it should be possible to correlate disease measurement with crop yield. Estimates of crop losses and decreases in financial returns with the resulting wise direction of national research into control for diseases placed in order of priority should be the ultimate objective.

Organization of disease measurement will in future be in the hands of the Disease Assessment Sub-Committee of the National Agricultural Advisory Service.

Genetics and cytology of fungi.—*Trans. Brit. mycol. Soc.*, xxxi, 3–4, pp. 353–356, 1948.

At a joint meeting of the British Mycological Society and the Genetical Society held in London on 8th March, 1947, S. Dickinson, speaking on fungal genetics, put forward the view that the linear and naked arrangements of the products of segregation in such fungi as the smuts may provide a profitable line of research on polarity or biased segregation. Miss E. Blackwell examined critically the terms in use for the organs of syngamy and the various mechanisms by which the products of these organs are brought together. C. Robinow described staining techniques for nuclei in bacteria and fungi, A. F. Parker Rhodes dealt with phenogenesis in fungi, G. Pontecorvo with the genetical aspects of heterokaryosis, K. Mather with genetical flexibility and the breeding system in fungi, and H. L. K. Whitehouse with some evolutionary aspects of heterothallism and heterokaryosis.

NEERGAARD (P.). **Suggestions for an international herbarium of plant pathogenic fungi.**—*Trans. Brit. mycol. Soc.*, xxxi, 3–4, pp. 346–348, 1948.

After pointing out that the issue of an international herbarium based on contributions from selected specialists, with the nomenclature steadily kept up to date, would make it possible to establish a much needed co-operation between mycological taxonomists and plant pathologists, the author puts forward a number of practical suggestions for the preparation and functioning of such an herbarium. Saprophytic members of genera containing parasitic forms should be included. Wherever possible, material of the same fungus (same collection) on a natural substratum and on an artificial medium should be issued. All the material for a given specimen should be from one locality and one crop or substratum. For determinations the co-operation of specialists would be invited. Suggestions are also made for labelling and for the publication of new species.

DILLON WESTON (W. A. R.) & TAYLOR (R. E.). **The plant in health and disease.**—xii+173 pp., 1 col. pl., 60 pl., 6 figs., London, Crosby Lockwood & Son, Ltd., 1948. 21*s.*

This interesting and well-illustrated book, written by authors who have had a wide practical experience of the subject, will be of great assistance to agriculturists and horticulturists. The 18 chapters deal, respectively, with plant diseases (ancient views and remedies, and modern views); the soil and the seed; the green plant and its environment; fungi and spore dispersal; classification; symptoms of disease and principles of plant protection; seed treatment—modern methods; diseases caused by seed-borne fungi—cereals and other farm crops; soil 'sickness'; soil-inhabiting fungi that cause disease; some tomato diseases; diseases spread by air-borne spores; nutritional disorders; virus diseases; legislation; and technical advice. Appendix 1 contains a list of diseases classified alphabetically under the common name of the host and giving the common names of the diseases and the pathogens classified systematically; appendix 2 is a list of useful references.

MOREAU (C.). **Les maladies parasitaires des principales cultures coloniales. Revue bibliographique. I.** [The parasitic diseases of the chief overseas crops. A bibliographical review. I.]—*Rev. Mycologie, Suppl. colon.*, xiii, 1, pp. 35–46, 1948.

This first instalment of an annotated bibliography of papers on bacterial and fungal diseases of the chief crops in tropical and semi-tropical areas reviews works published since 1st January, 1947. The notes are arranged in alphabetical order of hosts and are followed by a bibliography.

CANTER (HILDA M.) & LUND (J. W. G.). **Studies on plankton parasites. 1. Fluctuations in the numbers of Asterionella formosa Hass. in relation to fungal epidemics.**—*New Phytol.*, xlvii, 2, pp. 238–261, 2 figs., 9 graphs, 1948.

Detailed studies made during 1946, 1947, and 1948 demonstrated the parasitism of the chytridiaceous fungus *Rhizophidium planktonicum* n.sp. on the plankton diatom *Asterionella formosa* in Windermere, Esthwaite Water, and Blelham Tarn, in the English Lake District. At certain times, particularly in autumn and winter, the numbers of *Rhizophidium* increase rapidly, causing an epidemic with a corresponding reduction in numbers of live *Asterionella* cells. In other parts of the year the parasite does not affect the numbers of the diatom appreciably.

List of species maintained in the National Collection of Type Cultures.—*Memor. med. Res. Coun.* 21, 17 pp., 1948. [Issued by H.M. Stationery Office. 9*d.*]

In this list of species maintained in the National Collection of Type Cultures, at

Elstree, Hertfordshire, now restricted to bacteria and Actinomycetes, the species (the number of strains of each maintained is specified) are arranged alphabetically, the nomenclature following in general that of the third edition of Topley and Wilson's Principles of bacteriology and immunity. Several *Pseudomonas* spp. listed are of phytopathological importance.

Knight (R. L.). **Dictionary of genetics.**—xi+183 pp., Waltham, Mass., The Chronica Botanica Co., London, William Dawson & Sons, Ltd., 1947. $4.50.

This dictionary is described by the author as an attempt to define and standardize the technical terms which have been coined in late years by workers in the young science of genetics. It also comprises the recognized terms used in the older works on the subject, and should be of value to plant pathologists in view of the complex phraseology now current in papers dealing with the genetical aspects of plant diseases. A four-page bibliography is appended.

Palti (J.). **Root diseases and nematodes on field and garden crops in Palestine.**—vii+87 pp., 16 figs., 1 map. [? 1948. Hebrew, with English summary.]

The information presented in this booklet has been compiled from the ecological studies and records of root diseases in Palestine made by Dr. I. Reichert and his staff at the Division of Plant Pathology during the last 25 years. Many of the contributions have been noticed from time to time in this *Review*.

Babička (J.) & Semerád (A.). **Mikroflora skvrn surových kůží a usní.** [The microflora of stains of raw and tanned leathers.]—*Rozpr. české Akad.*, II, lii, 24, pp. 1–10, 1942. [Abs. in *Biol. Abstr.*, xxii, 5, p. 1158, 1948.]

Bacteria, moulds, and yeasts were isolated from stains on raw and finished leathers [cf. *R.A.M.*, xxvi, p. 311] and determinations made of those producing the stains. The microflora of 200 samples was studied and their part, if any, in the decaying process of leather established.

Illman (W. I.), Semeniuk (G.), Neish (A. C.), & Ledingham (G. A.). **Rot resistance of Cotton duck treated with chelate copper compounds.**—*Canad. J. Res.*, Sect. F, xxvi, 8, pp. 311–317, 1 pl., 1948.

After pointing out that organic reagents that form chelate complexes with heavy metals have received very little attention as copper fixatives in textiles, the authors describe experiments undertaken to compare the rot-proofing effectiveness [*R.A.M.*, xxvi, p. 253] of a number of cupric complexes of organic compounds capable of forming co-valent linkages with metals. The compounds used were 8-hydroxyquinoline, dimethylglyoxime, salicylaldoxime, benzoin oxime, acetoin oxime, fructose oxime, glucose oxime, 1-nitroso-2-naphthol, ammonium nitrosophenylhydroxylamine (cupferron), rhodanine, diphenylthio-carbazone, and *s*-diphenylcarbazide. The utilization of Canadian peat residues being also under study, the copper compound formed from ammonium humate was included. A preliminary soil burial test demonstrated that cupferron, 8-hydroxyquinoline, 1-nitroso-2-naphthol and dimethylglyoxime were the most promising materials. These were, therefore, compared with each other and with copper naphthenate over a wider range of copper concentrations. In this experiment, for each concentration of the five different treatments, eight samples of No. 8 cotton duck, 6 by $2\frac{1}{2}$ in., were subjected to soil burial, four for 35 days and four for 90 days.

The results showed that copper naphthenate was the least effective, all the samples being completely disintegrated after 90 days' burial; after 35 days at the highest copper concentrations (up to 1·1 per cent. of dry weight) the tensile strength was reduced to one-third, the strip containing the lowest concentration of copper

having disintegrated. Copper dimethylglyoxime was superior to copper naphthenate and copper 1-nitroso-2-naphthol at low copper concentrations, but inferior to the last-named at high concentrations. The 8-hydroxyquinoline and cupferron treatments were much superior to the others, allowing no significant decrease in tensile strength even after 90 days' burial when the copper concentration was 0·6 to 0·7 per cent. or over. Cupferron was, perhaps, slightly the better at the lower copper concentrations. Of the two materials, the authors prefer cupferron, since it can be applied from aqueous solution at room temperature and treatment confers only a light bluish-grey colour on the fabric, while the colour of the copper quinolinate treated strips was strong yellow.

Bayley (C. H.) & Weatherburn (M[uriel] W.). **Protection of rug backings against mildew attack.**—Reprinted from *Laundry dry Clean. J. Can.*, 2 pp., 1947.

At the National Research Laboratories, Ottawa, swatches of No. 8 unbleached cotton duck were uniformly sprayed (until damp) with three fungicide solutions, suspended by nylon threads from the tight-fitting caps of glass jars, containing $\frac{1}{2}$ to 1 in. water, and kept at 86° F. for 60 days. Complete inhibition of [unspecified] mildew growth was obtained with all three compounds. The following proportions are recommended for spraying the backing yarns of rugs and carpets to give noticeable damping: 2,2′ dihydroxy-5,5′ dichlorodiphenyl methane (preventol GD or compound G-4) [*R.A.M.*, xxvi, p. 253], $\frac{1}{3}$ oz. dissolved in isopropyl alcohol, diluted to 1 gal. with Stoddard solvent; mercaptobenzothiazole (captax), $1\frac{1}{2}$ oz. in cellosolve (ethylene glycol monethylether) and diluted as in the foregoing; sodium salt of salicylanilide (shirlan NA), $\frac{2}{3}$ oz. in 1 gal. water to which an amount of ammonia sufficient to effect solution has been added. Treatments may require renewal after cleaning. Contact of large amounts of the mixtures with the skin should be avoided and gloves should be worn during treatments.

Massart (L.). **Antagonism between basic compounds (spermine streptomycin) and basic bactericidal substances.**—*Nature, Lond.*, clxii, 4124, p. 779, 1948.

The basic bactericidal substances, trypaflavine ($5\times10^{-4}M$), methylene blue ($1\times10^{-3}M$), protamine sulphate ($2{\cdot}5\times10^{-4}M$), chinine ($2{\cdot}5\times10^{-3}$), and crystal violet ($1\times10^{-4}M$), cause a strong and progressive inhibition of the respiration of bakers' yeast suspended in glucose phosphate at 28° C. Spermine and streptomycin, although also basic substances, do not affect the respiration of yeast and thus have no direct bactericidal activity even at high concentrations (both at $1\times10^{-2}M$). All these substances compete for the same negative components of the yeast cell when brought in contact with a yeast suspension. It is postulated that basic substances will show direct bactericidal activity either when they possess a high molecular weight, or when this is achieved at definite concentrations by the aggregation of their organic residues. It has been shown at the University of Ghent that spermine at definite concentrations competes with bactericidal substances and is able completely to reverse the inhibition of respiration caused by trypaflavine, methylene blue, chinine, crystal violet, and protamine. Streptomycin reversed the inhibition of the first two of these substances [cf. *R.A.M.*, xxviii, p. 27].

Spilsbury (J. F.). **Observations on the nutritional requirements of Streptomyces griseus (Krainsky) Waksman & Schatz.**—*Trans. Brit. mycol. Soc.*, xxxi, 3–4, pp. 210–228, 2 pl., 6 graphs, 1948.

The author describes an experimental study of the nutritional requirements for the optimum growth of *Streptomyces griseus* [*R.A.M.*, xxvii, p. 253] and streptomycin production.

Møller (C. M.). **Mycorrhizae and nitrogen assimilation with special reference to Mountain Pine (Pinus mugo Turra) and Norway Spruce (Picea abies (L.) Karst.).**—*Forstl. Forsøgsv. Danm.*, xix, 2, pp. 105–208, 6 figs., 1947. [Danish summary.]

This paper presents the results of the author's studies since 1920 on mycorrhiza [*R.A.M.*, xxv, pp. 355, 518; xxvii, p. 192] and reviews the findings of other workers in this field. *Pinus mugo* and *Picea abies* have always been found to have typical ectotrophic mycorrhiza. The only intracellular hyphae observed were those which exceptionally penetrated and generally killed the outermost cortical cells. Active mors were most conducive to mycorrhizal development, mulls and very poor mors least so. Thus, for instance, mountain pine from the extremely poor locality at Hareskov Sande, Jutland, had only a few, poorly developed, dichotomous mycorrhiza. The poorer the soil the less exacting are the nitrogen requirements of the various species of fungi which contribute to ectotrophic mycorrhizal formation. As experiments with *Pinus mugo* cultured on nitrogen-free media failed to provide evidence of any ability of mycorrhiza to fix free atmospheric nitrogen, and as there is no proof of its ability to assimilate organic nitrogen compounds or exhibit true symbiosis, the occurrence of mycorrhizal fungi on roots may be only a type of epiphytism, any benefit resulting from their ability to decompose litter.

Investigations of various soils indicated that there had been a mobilization of nitrogen and humus in the 10-cm. soil layer in a plantation of *P. mugo* which has been established for about 40 years, but not under adjacent spruce. The bulk of the nitrogen had apparently been used for the growth of the pine and was found in the trees and their litter. The beneficial effect of growing *P. mugo* in *Picea abies* heathland plantations is attributed, among others, to this factor.

Harley (J. L.). **Mycorrhiza and soil ecology.**—*Biol. Rev.*, xxiii, 2, pp. 127–158, 1948.

This article, described as 'an attempt to approach the problem of ectotrophic mycorrhizas from a consideration of soil ecology', falls into the following sections: (1) introduction; (2) the spatial distribution of micro-organisms in soil; (3) the interrelationship of roots and micro-organisms; (4) the place of mycorrhizal fungi in the rhizosphere; (5) the conditions for mycorrhiza formation; (6) the influence of the micro-organisms of the root region on the activities of the host plant; and (7) a survey of hypotheses put forward to explain mycorrhizal phenomena. The paper concludes with a summary of the available information and a bibliography of 132 titles, many of which have been noticed from time to time in this *Review*.

Stevenson (F. J.). **Foreign Potato introductions.**—*Amer. Potato J.*, xxv, 7, pp. 259–265, 1948.

During the last 35 years large numbers of new varieties or species of potatoes have been introduced to the United States, the accessions in the record books of the Potato Project exceeding 25,000. More than 700 varieties and species of potatoes have been imported since 1930; in the same year two expeditions under the direction of the Division of Plant Exploration and Introduction brought several varieties from Mexico and South America, which, however, did not reveal any outstanding characteristics that were not present in the better-adapted local varieties and seedlings.

The most valuable contributions to the potato-breeding programme were collections introduced for specific purposes, such as Dr. Reddick's Mexican varieties of *Solanum demissum* [*R.A.M.*, xii, p. 190; xiii, p. 652] from which he has developed useful varieties highly resistant to late blight [*Phytophthora infestans*] in the field.

A considerable advance in the blight-resistance programme was achieved by the

introduction of true seed of 10 crosses of K. O. Müller from Germany [ibid., xi, p. 667; xiii, p. 52; xiv, p. 390] in 1932. Several selections show good commercial qualities and are highly resistant to blight in both tubers and foliage [ibid., xiii, p. 591; xiv, p. 496]; in inoculation tests in Maine they developed only small lesions on the lower leaves when the tubers were approaching maturity, while Green Mountains were killed 30 to 40 days earlier [ibid., xxvii, p. 151].

Menominee, Ontario, Seneca, Cayuga, Ostragis [ibid., xviii, p. 340], and Ackersegen derived their resistance to scab [*Actinomyces scabies*] from varieties introduced from Norway [ibid., xxvii, p. 88].

Some of the lines most resistant to leaf roll inherited their reaction from Triumph [ibid., xxvii, p. 332] introduced from Holland in 1935. Frisco was found to be resistant to ring rot [*Corynebacterium sepedonicum*].

In 1936, five varieties resistant to leaf roll were introduced from Scotland, and several selections from a cross with a Scotch parent showed resistance [ibid., xxiii, p. 271; xxv, p. 573].

Further introductions were made from Russia and Canada in 1939 and 1944, respectively. Since 1943 the United States Department of Agriculture has sent potato stocks to 34 foreign countries.

A description is given of the present official procedure in obtaining foreign introductions and the organization of an institute is recommended that would deal with the importation of potato material, its maintenance, and studies on its possible usefulness.

Silberschmidt (K.). **Observações sôbre o teor de virus de Batatinhas colombianas.** [Observations on the virus content of Colombian Potatoes.]—*Arq. Inst. biol. S. Paulo*, xviii, 15, pp. 289–312, 4 pl., 1948. [English summary.]

Determinations were made of the virus content of potato plants grown in insect-proof greenhouses at the Biological Institute, São Paulo, from tubers of three groups collected in Colombia, principally in the Boyacá region, namely, (1) wild or semi-cultivated forms found at altitudes of 3,000 ft. or more above sea-level; (2) the ordinary late-maturing commercial varieties probably comprised within the species *Solanum andigenum* [*R.A.M.*, xxvii, p. 35]; and (3) the so-called 'criolla' type of commercial varieties, very likely belonging to *S. rybinii*, which are cultivated at lower elevations and have a short dormant period.

Many varieties, mostly of group (1), were found to harbour an infective entity of the potato virus Y type. The symptoms induced by inoculation with the juice of nearly all the virus-containing varieties on White Burley tobacco were similar, consisting of small, round, chlorotic blotches on the medium-sized leaves. Tobacco plants infected by this virus and superinoculated with potato virus X developed an acute necrosis. *Nicotiana glutinosa* reacted to inoculation with the Colombian potato virus by stunting and leaf-crinkle. Besides the virus of the Y type, potato virus X was found in one of the commercial varieties of group (2) and in *S. juzepczukii*, a wild species indigenous to Bolivia and Peru, a specimen of which was procured from a Colombian experiment station.

Bawden (F. C.), Kassanis (B.), & Roberts (F[lorence] M.). **Studies on the importance and control of Potato virus X.**—*Ann. appl. Biol.*, xxxv, 2, pp. 250–265, 1 pl., 1948.

The authors describe methods of testing for the presence of avirulent strains of virus X in potato plants [*R.A.M.*, xxvii, p. 149]. These include transmission to indicator plants, plant-protection tests, and the use of serological methods. The virus content of different parts of the plant varies greatly, but is everywhere high enough for transmission to indicator plants at all times of the year. The virus

content of immature tubers is too low to give a precipitin reaction, but extracts from developing sprouts contain almost as much virus as extracts from foliage.

Infection of virus-free stocks of Majestic and Arran Banner with four different strains of virus X caused reduced yields of from 5 to 24 per cent. Scotch Stock Seed Majestic, infected with an avirulent strain of X, cropped better than the virus-free stock, and emphasis is laid on the need for considering factors in addition to freedom from viruses when selecting clonal lines for propagation.

Virus X was not transmitted by cutting healthy tubers with a knife already used to cut infected ones [ibid., xxvii, p. 441], while cut tubers whose storage parenchyma was rubbed with infective sap gave rise to virus-free plants. Infection resulted when sprouts were rubbed with infective sap, and the virus also spread from infected to healthy sprouted tubers kept in the same sack.

Spread under natural conditions is slow [ibid., xxvii, p. 577], and it is concluded that the maintenance of virus-free stocks under commercial conditions is possible if precautions are taken against contact with infected plants. The greatest danger to virus-free stocks is considered to be infected volunteer plants surviving from previous crops.

Hovey (C.) & Bonde (R.). **Physalis angulata, a test plant for the Potato leaf roll virus.**—*Phytopathology*, xxxviii, 6, pp. 505–507, 1 fig., 1948.

In addition to the information already noted concerning the use of *Physalis angulata* as an indicator for the potato leaf roll virus [cf. *R.A.M.*, xxvii, p. 493 and next abstract], these studies also confirmed that the peach aphid, *Myzus persicae* [loc. cit.], is the chief vector of the virus in Maine. About 75 per cent. of the indicator plants became infected when five viruliferous aphids were used to inoculate each *P. angulata* plant. The virus was transmitted by all the nymphal stages of *M. persicae*, the younger ones transmitting the disease as readily as the mature apterous aphids. Less than 0·1 per cent. of the winged peach aphids leaving potato fields in late summer were viruliferous when tested on *P. angulata*. About 24 per cent. which were known to have fed on infected potato plants were viruliferous. The virus was readily transmitted from infected *P. angulata* to healthy Katahdin potato plants by *M. persicae*, and typical leaf roll symptoms resulted. Infected potato plants in seed stocks appear to be the chief source of infection in Maine.

Kirkpatrick (H. C.). **Indicator plants for studies with the leaf roll virus of Potatoes.**—*Amer. Potato J.*, xxv, 8, pp. 283–290, 3 figs., 1948.

This is a full account, an abstract of which has already been noted [*R.A.M.*, xxvii, p. 493 and preceding abstract], of potato leaf roll virus transmission in New York. The rate of symptom development is most rapid in *Physalis floridana* and slowest and least reliable in expression in *Datura stramonium*. *P. floridana* had the highest percentage infection when one and five aphids (*Myzus persicae*) were used (70·2 and 98·3); *P. angulata* had the highest when ten aphids were used (78·5).

Köhler (E.). **Ein Schnellverfahren zum Nachweis des Kartoffel-A-Virus (vorläufige Mitteilung).** [A rapid method for the demonstration of Potato virus A (preliminary note).]—*Kartoffelwirtsch., Hamburg*, i, 3, p. 56, 1948. [Mimeographed reprint.]

The use of *Solanum demissum* as an indicator plant for the detection of potato virus A [*R.A.M.*, xxv, p. 413] represented a real advance in the differential diagnosis of the viruses affecting the crop. The method is, however, open to the objection that, at midsummer temperatures in the greenhouse, powerful strains of virus X may produce deep blackish-brown spots similar to those characteristic of virus A on the test plant. Recent experiments have shown that this inconvenience may be obviated, and the development of the necrotic lesions considerably

accelerated, by the excision, after inoculation, of the leaves or their terminal pinnae and transference to a moist chamber, preferably a Petri dish 2 cm. in height, the bottom of which should be covered with damp filter paper. After the leaves have been placed in the dish, the wounds on the petiole should be dabbed with a weak solution of potassium permanganate as a precaution against contamination. The dishes are then placed in a well-lighted room but not in direct sunlight. The necrotic spots are clearly visible after three to five days. The most dependable results were obtained with the terminal pinnae of the older, well-developed, smooth leaves of young, properly nourished plants.

ZIMMERMANN-GRIESS (S.). **Internal rust spot of Potatoes.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 174–180, 1 fig., 1947.

A study is described of the pathological condition of potato tubers variously known as 'internal rust spot' or 'internal brown fleck' [*R.A.M.*, xvi, p. 629; xxii, p. 271; xxvi, p. 315; xxvii, p. 158], first observed on a large scale in Palestine in the summer of 1938, when tubers (especially Arran Banner) were much affected and their market value was greatly reduced. Tubers were cut transversely to facilitate determination of the spots. The symptoms in Palestine agree with those described from other countries as non-parasitic internal necrosis of potato tubers [cf. ibid., xxv, p. 275].

The results obtained over five years showed that the condition occurs on light and heavy soils, is absent from crops lifted in winter, uncommon in those lifted in early spring, and increasingly serious in later spring crops, particularly those lifted late in summer. Of 24 varieties examined, Invincible and Champion were most susceptible, followed by Arran Banner, Kerr's Pink, and Red Skin. Up-to-Date, Majestic, and Epicure were affected very slightly when lifted very late, and some varieties were not affected even then. The small tubers of Arran Banner and Invincible, and the medium-sized tubers of the former variety were less affected than large ones. Experimental evidence demonstrated that the condition is not transmissible through affected seed tubers in the case of Arran Banner or Invincible.

LITTAUER (F.), VOLCANI (Z.), & TEMKIN-GORODISKY (N.). **Brown rot of Potatoes in Palestine.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 219–220, 1 fig., 1947.

Symptoms resembling those of brown rot were observed on potatoes in Palestine for the first time in three different localities in the spring of 1946 and in the spring and autumn of 1947. Considerable damage was caused at Hadera in 1947, the yield being reduced from 2½ or 3 tons to one ton per dunum [1,000 sq. m.]. The disease affected the two main varieties grown in Palestine, Up-to-Date and Arran Banner, and also attacked Kerr's Pink. The condition affected plants grown from tubers imported from England as well as plants grown from local, once-grown seed. The disease was found both on new ground and on land where potatoes had been grown the season before. Affected material contained *Pseudomonas* [*Xanthomonas*] *solanacearum* [*R.A.M.*, iii, p. 232; xxvii, p. 353, *et passim*], to which from the nature of the symptoms, which are described, the condition is attributed.

PALTI (J.). **Further work on the application of fungicidal sprays by overhead irrigation equipment.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 201–204, 1947.

In a field test carried out in Palestine on the control of potato blight (*Phytophthora infestans*) [*R.A.M.*, xxvi, p. 464] by overhead spraying [cf. ibid., xxiv, p. 198] a self-priming pump delivering 4 to 5 cm. per hour at a pressure of three atmospheres was coupled to a 3-h.p. Hardie sprayer. The outlet pipe of the pump was connected with an ordinary 'Matar' system. In this manner, overhead application of spray was made to plots 15 m. wide through irrigation pipe lines 65 m. long.

Paired plots of Up-to-Date potatoes sown in March, 1946, on heavy soil at Ein Hahoresh were sprayed with $\frac{1}{3}$ per cent. perenox (50 per cent. copper) on 29th April, 8th, 14th, and 30th May, 1946, the first symptoms of blight being recorded on 6th May. The rate of spraying through overhead pipes was 220 l. per dunum (1,000 sq. m.), applied in three to four minutes.

Representing blight incidence in the untreated controls as 100, then the figures for motor-sprayed and overhead sprayed plots were, respectively, 21 and 37, while the corresponding yields were 3,450 and 3,230 kg. per dunum, with 1,780 kg. for the unsprayed.

In the light of this result it is evident that the rate of spray application through overhead equipment need not exceed the ordinary rate of spraying by more than a small margin. There is emphatically no need to apply two or three times the usual amount of spray, as was formerly thought to be the case [loc. cit.].

Lunden (A. P.). **Forsøk med bekjempelsesmidler mot torråte (Phytophthora infestans) på Potet.** [Experiments with fungicides against dry rot (*Phytophthora infestans*) on Potato.]—*Meld. Norg. LandbrHøjsk.*, xxvii, pp. 237–270, 1947. [English summary.]

A tabulated survey is given of the results of nine experiments carried out from 1939 to 1944 in the control of potato late blight (*Phytophthora infestans*) with 1 per cent. Burgundy mixture, 0·4 per cent. copper-lime Bayer (Ob. 21) [*R.A.M.*, xx, p. 4], 0·75 per cent. kopermetallo (La Metallo Chimique, Brussels), and 0·4 per cent. copper dust Bayer, using 1 per cent. Bordeaux mixture as a standard of comparison. Two applications were given at the rate of 100 l. per $\frac{1}{4}$ acre, the first in the latter part of July and the second a fortnight later.

In the susceptible Up-to-Date variety the Bordeaux mixture treatments resulted in an average increase of 24 and 28·2 per cent. in the tuber and dry-matter yields, respectively, and of 10 per cent. in tuber size. The other sprays tested were slightly inferior to Bordeaux, but the differences were not significant, and both copper-lime and kopermetallo (used in four out of the six seasons) are very convenient in application. The performance of the copper dust (two years only) was not equal to that of the sprays. From an economic standpoint the spraying of susceptible varieties like Up-to-Date should prove well worth while, especially where the percentage of diseased tubers in the treated crop can be materially reduced by postponement of the second application or by killing or cutting off the haulms some days before harvest. In the case of the resistant Åspotet, however, the use of fungicides would only be profitable in seasons exceptionally favourable to the disease, such as 1944. The total tuber yield (average of all trials) was increased by 476 kg. (372 disease-free tubers and 119 kg. dry matter) per $\frac{1}{4}$ acre, almost exclusively in the 'ware' class, equivalent at present prices in Norway to an increase of 60 kroner (£3) in the value of the crop. Using a horse-driven machine, the cost of two applications should not exceed 12 to 25 kroner per $\frac{1}{4}$ acre.

De Castro (J. B.) & Boock (O. J.). **Variedade de Batatinha 'Konsuragis'.** [The Potato variety 'Konsuragis'.]—*Bragantia, S. Paulo*, vii, 6, pp. 151–170, 7 pl., 1 graph, 1947.

This is a tabulated survey and discussion of the authors' observations in São Paulo, Brazil, on the leading characteristics, including resistance to certain diseases [cf. *R.A.M.*, xvii, p. 17], of the Konsuragis potato variety, which was placed on the market by the firm of Rabbethge and Giesecke, Mühlendorf, Germany, in 1930. It has shown a reasonable degree of resistance to early and late blights (*Alternaria solani* and *Phytophthora infestans*) and is one of the slowest varieties to degenerate through virus infection. It is, however, susceptible to scab (*Actinomyces scabies*) and *Rhizoctonia* [*Corticium*] *solani*, and possesses little or no resistance to bacterial

wilt (*Phytomonas* [*Xanthomonas*] *solanacearum*), a serious disadvantage in view of the prevalence in the State of this highly destructive disease.

Săvulescu (T.). **O problemă actuală de patologie vegetală. Râia neagră a Cartofului in România.** [The topical problem in plant pathology. Black scab of Potatoes in Rumania.]—*Anal. Acad. române*, Ser. III, xviii, 8, 60 pp., 7 pl., 16 figs., 3 maps, 1943. [Received 1948.]

A full account is given of the geographical distribution of potato black scab [wart disease] (*Synchytrium endobioticum*), with special reference to its occurrence in Rumania [*R.A.M.*, xxv, pp. 439, 469], where it is very severe (50 to 100 per cent. infection) in the mining region of Lupeni-Petroșani (province of Hunedoara). This is followed by a survey of the symptomatology, morphology, and biology of the pathogen, its relation to environmental factors, varietal reactions to the disease, and control measures. A bibliography of 165 titles is appended.

Koblet (R.). **Untersuchungen über den Einfluss der Stickstoffdüngung auf den Krankheitsbefall und die Speisequalität der Kartoffel. I.** [Investigations on the influence of nitrogen manuring on the incidence of disease and palatability of the Potato. I.]—*Annu. agric. Suisse*, xlviii, 6–7, pp. 665–699, 3 figs., 1 graph, 1947. [French summary.]

A tabulated account is given of 30 experiments carried out in different parts of central Switzerland from 1943 to 1946 to determine the effect of increasing amounts of calcium nitrate (30, 60, and 90 kg. per ha.), in addition to a basic fertilizer of 50 kg. superphosphate and 70 kg. potassium sulphate, on the health and palatability of the widely grown Ackersegen and Voran potatoes, Bintje and Robusta (a fodder variety) being included in the last season's trials.

Heavy applications of nitrogen led in some cases to a fairly high incidence of late blight (*Phytophthora*) [*infestans*], apparently associated with luxuriant foliar growth, and increased the extent of tuber infection by the same pathogen and wet rot [*Erwinia phytophthora*]. Extreme care in the preventive spraying of blight-susceptible varieties is doubly necessary, therefore, where liberal nitrogenous soil amendments are applied. The carefully selected culinary lots from the plots heavily manured with nitrogen showed no increasing tendency to wet and dry rot (*Fusarium* spp.) in storage as compared with those receiving no extra nitrogen.

No influence on 'Eisenfleckigkeit' [internal rust spot: *R.A.M.*, xxvii, p. 153] or hollow heart [loc. cit.] was exerted by the addition of calcium nitrate to the fertilizer, but heavy dosages (60 or 90 kg.) of the compound clearly raised the incidence of blackening on cooking [loc. cit.] in the susceptible Voran. The same treatments also tended to enhance the mechanical injury inflicted by rough handling [loc. cit.].

The palatability of the experimental lots did not appear to be influenced by the nitrogenous fertilizer.

Krantz (F. A.) & Eide (C. J.). **Resistance to common scab of Potatoes in parental clones and in their hybrid progenies.**—*Amer. Potato J.*, xxv, 8, pp. 294–300, 1948.

Investigations into the resistance of potatoes to common scab (*Actinomyces scabies*) [*R.A.M.*, xxvii, p. 88], carried out at Grand Rapids, Minnesota, during 1946 and 1947, confirmed that consistent ratings for mean scab index [ibid., xvii, p. 766] can be obtained annually by growing four hills of a clone in a heavily infested test plot. The method of selecting single non-infected seedlings in the first clonal generation from the scab test plot is not reliable, however, for isolating resistant plants. Selection for scab resistance should be made in later generations. Crosses between parents exhibiting equal resistance gave progenies which differed

widely in percentage of resistant seedlings. Nevertheless, there was a general correlation between the resistance of parent clones and of their hybrid progeny. Crosses between parents derived from the same resistant ancestor resulted in progenies which were slighty less resistant than those from parents whose resistance was derived from different sources. A test of 399 selections from 30 crosses showed that when both parents had a scab index of 3 or less, 11 to 37 per cent. of the progeny had an index of 2 or less, and 43 to 63 per cent. of 3 or less. The best results came from the cross 51 × 52, the progeny of which had a mean scab index of 2·5, 50 per cent. of the seedling clones having an index of 2 or less.

Bolas (B. D.) & Portsmouth (G. B.). **Effect of carbon dioxide on availability of manganese in soil producing manganese deficiency.**—*Nature, Lond.*, clxii, 4123, p. 737, 1948.

The results of several years' experiments in which potato plants were grown in pots and also in the field in soil producing manganese deficiency [*R.A.M.*, xxvii, p. 583] led to the hypothesis that local accumulations of carbon dioxide within the root masses might render manganese available. The soil was obtained from a recently drained lake bed at East Malling; it is an alluvial deposit containing a large amount of calcium carbonate and organic matter and with pH 8 to 8·5. Although ample manganese is present the amount available to plants is very small, as plants containing under 1 p.p.m. on a fresh weight basis and showing acute deficiency symptoms are commonly present in certain parts of the area. Attempts to reproduce these conditions in the same soil in pots in no case gave plants with such marked symptoms or such low manganese content. Water extracts of soil from the pots or the lake bed contained negligible amounts of extractable manganese, though plants in pot culture in the summer of 1948 displayed no manganese deficiency. It was shown by experiment that water-soil mixtures contained much higher proportions of extractable manganese after treatment with carbon dioxide, the highest amount occurring in the one saturated with carbon dioxide.

Dalton (F. H.) & Hurwitz (C.). **Effect of volatile disinfectants on survival of microflora in soil.**—*Soil Sci.*, lxvi, 3, pp. 233–238, 1948.

At the Massachusetts Agricultural Experiment Station the effects of chloroform, hydrogen cyanide, formaldehyde, chloropicrin, and ethylene oxide on the survival of soil microflora, moulds, Actinomycetes, and bacteria were determined. Ethylene oxide sterilized the soil after 11 hours' exposure, formaldehyde after three days, and chloropicrin after eight. Chloroform and hydrogen cyanide decreased the population of viable micro-organisms, but did not effect complete sterilization after ten and eight days' exposure, respectively.

Not only was ethylene oxide superior to the other disinfectants tested in its lethal action on the soil microflora, but it induced smaller changes as measured by the increases in ammonium acetate-soluble copper and manganese. On the other hand, the increases in these substances resulting from soil treatments with chloropicrin and formaldehyde were considerable, far exceeding, in fact, the concentrations reported as toxic to plants. The relative inefficiency of hydrogen cyanide and the adverse effects on the soil of chloropicrin and formaldehyde are of practical interest in view of the extensive use of these disinfectants in seed-bed preparation and greenhouse soil treatment.

Chowdhury (S.). **On the control of Rhizoctonia root-rot of Pan (Piper betle L.).**—*Sci. & Cult.*, xiii, 12, pp. 507–508, 1948.

Root rot of *Piper betle*, caused by *Rhizoctonia* [*Corticium*] *solani*, is a serious problem in the Sylhet district [of Assam: *R.A.M.*, xxiv, p. 248] and during the last

four years experiments have been carried out in the control of the pathogen by crop rotation. Continuous cropping with *Imperata arundinacea* from 1940 to 1943 resulted in the absolute elimination of infection in 1944–5, 1945–6, and 1946–7, while the average percentages of mortality of *P. betle* from *C. solani* after four years' continuous cropping with rice, potato and jute, tobacco and sunnhemp, and *P. betle* were 4·2, 6·7, and 5; 8·6, 12·5, and 9·7; 3·2, 4, and 4·2; and 18·7, 20·5, and 24·5, in the three years respectively.

Combate ao 'carvão' nos canaviais de São Paulo. ['Smut' control in the Cane fields of São Paulo.]—*Brasil açuc.*, xxxi, 3, pp. 278–280, 1948.

The existence of sugar-cane smut [*Ustilago scitaminea*] in the State of São Paulo was demonstrated in material sent to the Biological Institute from Assis in December, 1946 [C.M.I. map 79]. The following are some of the measures proposed or already undertaken for its control, embodied in a report addressed by F. de O. Guena, Head of the Southern Technical Industrial Inspectorate, to the President of the Institute of Sugar and Alcohol. Owners of diseased plantings were required to destroy them immediately after cutting, the work to be completed by 31st October, 1947, at the latest. In view of the relative smallness of the affected area and its remoteness from the important cane-growing centres of the State, the most practical programme for the eradication of the pathogen consists in the total elimination of the plantations and the prohibition of planting canes of any variety throughout the zone for a minimum period of four years. All plants of the susceptible varieties P.O.J. 213, P.O.J. 36, and C.P. 320, which cover a mere fraction of the area under cultivation in the State, should be destroyed. A corps of inspectors should be maintained in all districts to keep the plantations under constant observation for the appearance of fresh outbreaks of the disease.

Buchwald (N. F.). **Mycology.**—*Ex* The Humanities and the Sciences in Denmark during the second world war, pp. 300–305, 1948.

The author briefly surveys the mycological studies accomplished in Denmark during the war of 1939 to 1945 under the headings of taxonomy, morphology and cytology, physiology, genetics, and ecology and floristics. Some of the papers comprised in the bibliography of 51 titles have been noticed in this *Review*.

Velenovský (J.). **Velenovskýi species novae Basidiomycetum.**—301 [+17] pp., 1 pl., Prague, Botanical Society of Czechoslovakia, Antonín Lapáček, 1948. 200 Kčs, £1, or $4.

This publication, by the Botanical Society of Czechoslovakia to commemorate Velenovský's ninetieth birthday, lists his published works and gives diagnoses, translated into Latin by A. Pilát, of some 800 species of fungi described as new by Velenovský in Czech in České houby (Fungi Bohemiae), 1920–2. Some 700 of these new species are agarics, the remainder other Hymenomycetes, Gasteromycetes, and two Ascomycetes. Supplementary to each group and genus are listed the new genera and species of Basidiomycetes published in Novitates Mycologicae, 1939, and Novitates Mycologicae Novissimae, 1947 [*R.A.M.*, xxvi, p. 421].

Balakrishnan (M. S.). **South Indian Phycomycetes—II. Some little known species of Pythium occurring in South India.**—*Proc. Indian Acad. Sci.*, Sect. B, xxviii, 1, pp. 27–34, 4 figs., 1948.

Four species of *Pythium*, including one new variety, are reported for the first time from India and their morphological characters described. *P. paroecandrum*, hitherto recorded only in the United States [*R.A.M.*, xix, p. 435], was isolated from rotting bean (*Phaseolus vulgaris*) pods from the market at Coimbatore.

Ramakrishnan (T. S.) & Rangaswami (G.). **Uromyces acori Ramakrishnan and Rangaswami sp. nov. on Acorus calamus L.**—*Curr. Sci.*, xvii, 8, pp. 240–241, 3 figs., 1948.

Acorus calamus growing in the vicinity of Ootacamund, India, was affected by a rust in March, 1948, the uredo state of which was found to be identical with *Uredo acori*. Growing among the uredospores were pedicellate, unicellular, ovate to elliptical, yellowish-brown teleutospores, 30 by 21 (27 to 36 by 16 to 25) μ; apical thickening was up to 14 μ, a single germ pore was present at the apex, and the persistent, hyaline or subhyaline stalks measured up to 41 by 11 μ; hyaline or subhyaline, clavate paraphyses were mixed with the teleutospores. The rust is named *Uromyces acori* n.sp.

Reichert (I.) & Hellinger (Esther). **On the occurrence, morphology and parasitism of Sclerotium bataticola.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 107–147, 2 pl., 6 figs., 1 map, 1947.

The authors present detailed data obtained from experimental studies on *Sclerotium bataticola* carried out in 1927–8, a preliminary note on which appeared in 1928 [*R.A.M.*, ix, p. 81]. The full results of this and subsequent work are now given in the light of the researches since carried out in various countries on the fungus concerned. The problem concerned the determination of the parasitic vigour of the various isolates obtained from hosts in Palestine, whether they were all pathogenic to the hosts with which they were associated, and whether they differed in morphology, physiology, or pathogenicity.

The authors consider that the name *Rhizoctonia bataticola* should be discarded, *Macrophomina phaseoli* should be applied solely to strains forming pycnidia only, *S. bataticola* to those forming sclerotia only, while those forming both pycnidia and sclerotia should be referred to as *Macrophomina* (*Sclerotium*) *phaseoli*. An up-to-date review of plants attacked shows that from Palestine 118 host plants have been recorded, and 132 for other countries. The geographical distribution of the disease indicates its dependence on ecological factors, chiefly high temperature and humidity.

A comparative study of the morphology of isolates from bean (*Phaseolus vulgaris*), eggplant, potato, [chilli] pepper, *Cicer arietinum*, tomato, pumpkin, cotton, tobacco, and sesame showed that the sesame, tobacco, and cotton isolates produced coarse, persistent, aerial mycelium with abundant barrel-shaped cells, dense, and in the sesame isolate, more or less uniformly distributed in concentric zones, but irregularly produced in the cotton and tobacco isolates. The remaining isolates, except that from pumpkin, had a fine, collapsing mycelium with a very slight production of dark hyphae and barrel-shaped cells. The pumpkin isolate resembled the latter group in general, but produced relatively more hyphae and barrel-shaped cells.

Five distinct types of sclerotial formation were noted. Type I occurred in all isolates and arose from barrel-shaped cells along a single hypha; type II from two adjacent hyphae; type III from normal cells of a single hypha; type IV from two adjacent hyphae; and type V from barrel-shaped cells of one hypha fusing with normal cells of a second. Type II occurred in the bean, potato, chilli, *C. arietinum*, tomato, and pumpkin isolates; types III and IV in the cotton, tobacco, and sesame isolates; and type V only in the chilli. The ten isolates did not differ conspicuously in sclerotial size or in their mycelial features; the sclerotia were, however, roundish and smooth in the bean, eggplant, potato, chilli, *C. arietinum*, tomato, and pumpkin isolates and more or less irregular in the cotton, tobacco, and sesame isolates. When the ten isolates were grown on potato wedges above water the sesame isolate gave a deep-yellow colour to the liquid distinct from the colour produced by the other isolates (pinkish or yellowish) except perhaps that from *C. arietinum*, which was a less intense yellow.

In inoculation tests all the isolates except that from sesame attacked bean; eggplant, tomato, pumpkin, and *C. arietinum* remained uninfected.

S. bataticola is divided into three sub-species: (1) *typica*, pathogenic to bean and characterized by a fine, quick-growing, non-persistent mycelium, and smooth, round sclerotia more or less evenly distributed; barrel-cells and 'fumaceous' [? dark brown] hyphae being scarce; it includes isolates from bean, tomato, chilli, potato, eggplant, pumpkin, and *C. arietinum*; (2) *sesamica*, non-pathogenic to bean and characterized by a slow-growing, dense, persistent, 'fumaceous', concentrically zoned mycelium with abundant barrel-shaped cells and irregularly distributed sclerotia; represented by the sesame isolate alone; and (3) *intermedia*, pathogenic to bean, and characterized by a slow-growing, non-uniform, persistent, fumaceous mycelium with irregularly distributed sclerotia and comprising the tobacco and cotton isolates.

The list of references has 165 titles.

Fulton (R. W.). **Hosts of the Tobacco streak virus.**—*Phytopathology*, xxxviii, 6, pp. 421–428, 2 figs., 1948.

In order to determine the incidence of the tobacco streak virus [*R.A.M.*, xxvi, p. 47] in wild and crop plants, collections of apparently healthy specimens and others showing virus-like symptoms were made on six farms near infected tobacco fields in Wisconsin in the late summer and autumn of 1946 and in spring, 1947. The leaves of healthy Havana-Seed tobacco plants in the greenhouse were inoculated with leaf extracts from the plants. Burdock (*Arctium minus*) appeared to be most commonly infected with the virus, the leaves appearing strikingly toothed and thickened with prominent, light-coloured veins. Other naturally infected hosts were *Sisymbrium officinale*, white clover (*Trifolium repens*), *Convolvulus arvensis*, and plantain (*Plantago major*). Owing to its perennial habit and wide and abundant distribution the burdock fulfills all the requirements for an overwintering host of the streak virus.

The experimental host range was found to include 87 species (representing 21 families) out of 169 selected at random and inoculated in the greenhouse with fresh extract of the streak virus from recently infected tobacco plants.

The infection of *Fragaria virginiana*, *Geum* sp., and *Potentilla monspeliensis* and the subsequent recovery of the virus in tobacco is of interest since it has been stated that no virus infecting this family is known to be transmitted mechanically [ibid., xxiv, p. 326]. Inoculum prepared from tobacco leaves inoculated five to ten days previously was much more infective than inoculum from systemically diseased, or upper, symptomless tobacco leaves. The infectivity of the inoculum decreased rapidly within 15 minutes after leaf tissue was ground.

In attempts to discover a host more suitable than tobacco for research, it was found that guar, *Cyamopsis tetragonalibus*, proved much more susceptible to the virus than bean [*Phaseolus vulgaris*]. Small, dark, local lesions appeared rapidly after inoculation and remained distinct for some days. Several hundred lesions could be counted on one leaf. Some measurements of virus infectivity on *C. tetragonalibus* are presented.

Rozendaal (A.) & van der Want (J. P. H.). **Over de identiteit van het ratelvirus van de Tabak en het stengelbontvirus van de Aardappel.** [On the identity of the Tobacco rattle virus and the Potato stem-mottle virus.]—*Tijdschr. PlZiekt.*, liv, 4, pp. 113–133, 12 figs., 1948. [English summary.]

After a summary of Rozendaal's studies on the stem-mottle virus of potato in Holland [*R.A.M.*, xxvii, p. 33], van der Want's comparative observations and experiments on the same disease and tobacco 'rattle' [ibid., xxvii, p. 34] are fully described.

In 1946 healthy tobacco plants, sown and transplanted by van der Want in steamed soil and then transferred to a field in which tobacco had not previously been grown, contracted natural infection by the 'rattle' disease, thereby demonstrating the existence of one or more other hosts of the causal virus. Inoculation experiments with the latter on tobacco were unsuccessful during the summer months, but those performed in the autumn resulted in the development of local lesions after about five days and of systemic symptoms in 10 to 14. In view of the many similarities between potato stem-mottle and tobacco 'rattle' it was of interest to carry out cross-inoculation tests, and tobacco was accordingly infected by the former virus in the autumn of 1946, when primary symptoms appeared in eight days as greyish-brown spots, often arc- or ring-shaped. There were no subsequent systemic manifestations of stem-mottle.

In the autumn of 1947 large-scale experiments were undertaken jointly by both authors. The results may be summarized as follows. The stem-mottle virus from Bevelander potatoes produced local lesions on Havanna II C tobacco in four days, the incubation period and the symptoms being the same as those of 'rattle'. As in 1946, infection remained local. The same local symptoms developed in tobacco inoculated with juice from potatoes infected both by stem-mottle and virus X, of which only the latter became systemic. No local lesions were formed on plants inoculated with juice from recovered potatoes, from which the virus had evidently been entirely eliminated and was no longer present in a symptomless form. The stem-mottle virus from Beteka potatoes induced the same local symptoms in tobacco after four days as that from the Bevelander variety, but in this case the systemic expression of the disease followed six days later. It was identical with that of the 'rattle' virus and the incubation period was also the same. Juice from Magneto potatoes jointly infected by stem-mottle and virus X caused local lesions on tobacco in three days, and a week later the first systemic symptoms appeared. The leaf above the inoculated ones showed typical 'rattle' symptoms, while the younger foliage was mottled, with some necrotic spots, pronounced vein-clearing, and small, yellow markings. These deviations from the characteristic features of 'rattle' are an obvious result of the stem-mottle–X virus combination, which induces a disease of the 'complex' type. Juice from Duke of York potatoes affected with the stem-mottle disease produced local lesions similar to those of 'rattle' on tobacco, the X virus alone becoming systemic.

Experiments with the juice of Bevelander and Beteka potatoes affected by stem-mottle, and that of Magneto and Duke of York containing the same virus plus X, on Duke of York, Bevelander, and Beteka resulted in the development on the leaves of local necrotic streaks, arcs, and rings. Identical symptoms appeared when the same varieties were inoculated with the 'rattle' virus from tobacco. The reactions were exclusively local except in Beteka inoculated with Duke of York and Magneto juice, in which case the X component was responsible for the subsequent development of systemic symptoms. The progeny of the inoculated plants did not show symptoms of stem-mottle.

It is apparent from these experiments that the stem-mottle and 'rattle' diseases are related, if not identical, and also that different strains of the viruses exist.

In 1947 tubers of the four above-mentioned potato varieties, and five others, were planted alternately with healthy tobacco plants in a field where 'rattle' disease had been severe in the previous summer. Neither stem-mottle nor 'rattle' symptoms developed in the potatoes during the year of planting. In the spring of 1948 some of the harvested tubers showing clear-cut symptoms of 'sprain' [loc. cit.] were planted in the experimental field of the Laboratory for Mycology and Potato Research, the soil of which is free from the stem-mottle virus. The Bevelander, Beteka, Eigenheimer, Magneto, Ysselster, and Geelblom plants developed, respectively, 37, 22, 9, 9, 7, and 3 per cent. stem-mottle. It is apparent from these

experiments that potatoes planted in soil infested by the 'rattle' virus may contract the stem-mottle disease.

Tobacco and Duke of York potato plants were grown in pots filled with soil contaminated by the stem-mottle virus taken from three different plots at two depths (0 to 22 and 22 to 45 cm.). For comparison, potatoes were planted and tobacco sown in soil from a field where the 'rattle' disease had occurred on tobacco the year before. The potato plants grown in pots all remained healthy. The tobacco plants, transferred from the six stem-mottle soil samples to a field which had previously carried neither tobacco nor potatoes, developed from 0 to 100 per cent. 'rattle', the virus of which was present at both the upper and lower levels. Tobacco sown in 'rattle'-diseased soil contracted 1 per cent. infection.

Van der Want (J. P. H.) & Rozendaal (A.). **Electronen-microscopisch onderzoek van het virus, dat de ratelziekte van der Tabak en het stengelbont van der Aardappel veroorzaakt.** [Electron-microscopic study of the virus responsible for the rattle disease of Tobacco and the stem-mottle of Potato.]—*Tijdschr. PlZiekt.*, liv, 4, pp. 134–141, 2 figs., 1 graph, 1948. [English summary.]

Juice from tobacco and *Nicotiana rustica* plants inoculated with the 'rattle' virus [see preceding abstract] was purified by two methods for examination under the electron microscope. The first involves salting out with ammonium sulphate [*R.A.M.*, xxvii, p. 200]. The second, more rapid procedure consists in keeping the plants overnight at −20° C., thawing, centrifuging the expressed juice at 3,500 r.p.m., mounting directly on the membranes, either undiluted or in dilutions of 1 in 10 and 1 in 50, and drying in the air. The mounted viruses are then prepared with gold by the shadow-casting technique [ibid., xviii, p. 543 *et passim*]. Both methods are also applicable to the potato stem-mottle virus (caused by the same virus as 'rattle' but perhaps a different strain) and were used on juice from infected Beteka, Bevelander, Duke of York, and Magneto leaves. Of these varieties, Duke of York is a symptomless carrier of potato virus X, which was further shown by inoculation tests to be present in Magneto. The stem-mottle virus from the four varieties was inoculated into tobacco and *N. rustica* and the juice purified by the two procedures.

Under the electron microscope the 'rattle' and stem-mottle viruses were resolved into rod-shaped particles of variable length with two peaks, one at about 150 and the other at 300 mμ, and an estimated width of roughly 20 mμ. The relationship of some globular particles, approximately 25 mμ in diameter, to those of 'rattle' and stem-mottle is doubtful. The filiform, curled X-virus particles observed by Takahashi and Rawlins [ibid., xxvi, p. 183] were intermingled with, but readily distinguishable from, the stem-mottle rods in the Duke of York and Magneto preparations. There was no apparent aggregation of the 'rattle' and stem-mottle virus particles during 2½ months' storage of the chemically purified sap at 0° to 2° C.

Cuzin (J.) & Schwartz (D.). **Études d'épidémiologie statistique de la mosaïque du Tabac. III. Analyse chronologique (progression de la maladie).** [Studies of statistical epidemiology of the Tobacco mosaic. III. Chronological analysis (progression of the disease).]—*Ann. Inst. Pasteur*, lxxiv, 6, pp. 485–503, 3 graphs, 1948.

In further studies on the statistical epidemiology of the tobacco mosaic virus in France [*R.A.M.*, xxviii, p. 35], a chronological analysis was made of the disease in plots of naturally contaminated soil compared with those in which the plants were subjected to 'normal' and 'special' inoculation, the former operation being performed during the normal growing season and the latter on a basal leaf immediately after transplanting. The two modes of inoculation produced significantly

different effects both as regards the incidence of infection and the distribution of the latent periods. Whereas 'normal' inoculations resulted in the development of mosaic over a relatively short period (90 per cent. in five days) after a brief incubation of 8 to 11 days, in the 'specially' inoculated plots the disease was present throughout the growing season, appearing in three waves. The first, undoubtedly the direct result of inoculation, extended over a longer period (90 per cent. infection in 20 days) than in the 'normal' series, and was preceded by a longer incubation, probably 17 days. The two later waves were attributable to the spread of the virus by hoeing and rain.

Under normal conditions of culture in contaminated soil the initial infection by the tobacco mosaic virus presumably occurs during transplanting. This is directly responsible for the effects observed during the next month (the duration of incubation of the first wave probably being 24 days), and the direct or indirect cause of those developing over the first 50 days at least. There is thus a fundamental analogy between the results of natural infection and those induced by 'special' inoculation. These observations are of practical importance as indicating the need for stringent safeguards against contamination from the soil at the moment of transplanting.

Another factor to be considered in the epidemiology of tobacco mosaic is the varying predisposition of the host according to its growth rate. Thus, the prolonged incubation period following infection either at transplanting or when the plants are approaching maturity corresponds to the normally weak growth at these times. On the other hand, at a time of active development the period of latency is brief. The parallelism manifested in the three waves of infection is maintained throughout the growing season: between transplanting and harvesting, the variation in the number of diseased plants as a function of time is represented by a sigmoid curve which tallies precisely with the law of growth during the same period.

Dschunkowsky (E.). **Différents aspects cliniques de la mosaïque du Tabac en rapport avec l'existence de plusieurs virus de cette maladie.** [Different chemical aspects of the Tobacco mosaic in relation to the existence of several viruses of this disease.]—*C.R. Acad. Sci., Paris*, ccxxvii, 5, pp. 366–367, 1 fig., 1948.

The definitive results of the author's observations on the tobacco mosaic virus in Jugoslavia (communicated in part to the 14th International Congress of Agriculture, Bucarest, in 1929) may be summarized as follows. A form of the virus (designated C) exists which is transmissible solely by insects. The disease is widespread in tobacco plantations, but its transmission by ordinary laboratory methods is impracticable. Another virus (D) is pathogenic only to *Nicotiana rustica*.

The great variability of the clinical symptoms of the disease is remarkable. Whereas in certain plants the modifications only involve a few leaves and consist merely in colour changes and the formation of discrete necrotic foci, in others growth is entirely arrested and their misshapen leaves present bizarre aspects. When the malady assumes a chronic form, small neoplasms develop after some months on the stems near the points of insertion of the leaves, the plants meanwhile remaining green.

Herbarium specimens of diseased tobacco from Macedonia display symptoms hitherto undescribed pointing to the existence in that region of particularly virulent entities.

Köhler (E.) & Panjan (M.). **Das Paramosaikvirus der Tabakpflanze.** [The paramosaic virus of the Tobacco plant.]—*Ber. dtsch. bot. Ges.*, lxi, 5, pp. 175–180, 2 figs., 1944. [Received December, 1948.]

Six samples of mosaic-diseased tobacco from Baden yielded a hitherto undescribed virus herein designated the paramosaic virus of tobacco (PTM) [*R.A.M.*, xxviii, p. 3]. Though differing widely in its symptomatology from the tobacco mosaic

virus (TM), the new virus agrees with the latter in a number of properties, e.g., a thermal death point of just over 90° C. (ten minutes' exposure) and in dried leaves survival of 15 minutes at slightly over 100° or even 110°; the latter temperature, however, was apparently better tolerated by TM than by PTM. Sap inoculation with both viruses induced definite infection in two tobacco varieties (a form of Samsun Bashi Bagli and White Burley), *Nicotiana rustica*, *N. glutinosa*, *N. quadrivalvis*, *Datura stramonium*, chilli, *Nicandra physaloides*, *Solanum nigrum*, *S. miniatum*, *S. demissum*, *Schizanthus pinnatus*, *Phacelia whitlavia*, *Tetragonia tetragonoides*, *Cynoglossum amabile*, and Golden Cluster Wax bean (*Phaseolus vulgaris*).

White Burley tobacco was found to serve as a most useful differential host of the two viruses, PTM producing very conspicuous brown, necrotic primary lesions on the leaves, with no further development of secondary symptoms in contrast to the point or imperceptible chlorotic spotting caused by TM, followed by the typical mosaic pattern as displayed by Samsun. The initial symptoms of PTM on the latter variety are more or less prominent, circular, chlorotic spots with washed-out margins. The secondary manifestations fall into four phases, viz., (1) a well-defined vein-clearing similar to that caused by [potato] virus Y, (2) a strikingly characteristic mosaic pattern, (3) a typical coarse mosaic spotting, which merges into (4) a spotting reminiscent of the faint lines of tobacco mosaic but entirely devoid of blisters in the dark green areas. The entry of the virus through the petioles into hitherto uninfected leaves is marked by the development of a typical more or less necrotic, oak-leaf pattern along the side veins, closely simulating the symptoms of the tobacco ring spot virus.

Premunity (cross-immunity) experiments with the TM and PTM viruses yielded remarkable results. White Burley tobacco plants, inoculated at an early stage with the mild but otherwise typical green strain of tobacco mosaic virus, TM/W, contracted no further infection when superinoculated with PTM. This would point to a relationship between the two viruses. However, when Samsun plants pre-infected with PTM were superinoculated with a typical so-called 'aucuba' variant of TM, the latter made unimpeded progress, as shown by the subsequent development in the leaves of the growing shoot tips of a yellow spot mosaic, representing a mixture of the two viruses. This contradictory behaviour may be interpreted as follows. The infection of tobacco plants with the tobacco mosaic green strain led to a depletion in the host of a radicle of the virus protein no less indispensable to PTM than to TM, hence the inability of the former to make headway against the latter. On the other hand, in the plants infected by PTM the depleted radicle is inessential or useless for the building-up of the aucuba strain of TM, which could therefore multiply unchecked in the presence of the already existing virus and flow with the assimilated nutrients into the shoot tips.

It is concluded from these studies that PTM is a highly abnormal variant of TM, much more stable than the latter or any of the mutants as yet recognized. Being well able to withstand environmental antagonism, it might easily become endemic in a given tobacco-growing area.

Van der Ven (R.) & van der Want (J. P. H.). **Thielaviopsis basicola (Berk. et Br.) Ferraris als veroorzaaker een voor Nederland nieuwe ziekte van de Tabak.** [*Thielaviopsis basicola* (Berk. & Br.) Ferraris as the agent of a Tobacco disease new to the Netherlands.]—*Tijdschr. PlZiekt.*, liv, 4, pp. 142–146, 2 figs., 1948. [English summary.]

In connexion with the discovery in May, 1948, for the first time in Holland, of black root rot (*Thielaviopsis basicola*) [see next abstracts] in tobacco plantings in the Maas and Waal district, some important contributions to the literature on the disease and its control are summarized. Kentucky Italiana was the variety chiefly

affected, but Havanna IIC, Maas en Waalse, Keurhorst Elite, and brown Mont Calme also sustained a certain amount of damage.

JENKINS (W. A.). **Root rot disease-complexes of Tobacco in Virginia. I. Brown root rot.**—*Phytopathology*, xxxviii, 7, pp. 528–541, 5 figs., 1948.

Field, greenhouse, and laboratory studies on tobacco root rots, which have been in progress at the Virginia Agricultural Experiment Station since 1942, provide conclusive evidence that brown root rot should be classed as one of the root rot disease-complexes.

Affected plants present unmistakable symptoms of drought injury. In general, they do not make satisfactory growth after transplanting. The leaves undergo alternate periods of wilting and recovery in the early stages of the disease, but as the season advances they often partially or wholly fail to regain turgidity, resulting in stunting and coarsening accompanied by varying degrees of tip-burning and rim-firing. Severely diseased plants frequently show nutrient deficiency symptoms.

Brown root rot symptoms are more clearly defined on the feeder root system, the mutilation of which is typically so severe as to prevent the adequate performance of its function. The colour changes in the lesions, ranging from water-soaked to pale yellow and finally brown to black, generally follow cortical fissures, which completely girdle the roots, extend into the cambial zone, and result in loss of the cortical tissues through sloughing-off. Root mutilation is often accompanied by decay, the extent and severity of which vary with such factors as soil temperature, moisture, calcium level, and biological associates in the rhizosphere, such as *Fusarium* and *Pythium* at first, followed later by *Mucor* spp., *Macrophomina phaseoli*, *Thielavia basicola* [*R.A.M.*, xxvii, p. 298 and next abstract], and *Thielaviopsis basicola* [ibid., xxviii, p. 5]. Under local conditions, brown rot is initiated by the feeding habits of members of the meadow nematode group [cf. ibid., xxviii, p. 10], of which *Paratylenchus* [*Anguillulina*] *pratensis* consistently produces severe symptoms [ibid., xxvii, p. 264].

Effective control of the disease has not been achieved, though temporary benefit may be conferred on the current crop by such measures as supplementary nitrogen applications, rotations with tobacco varieties of different genetic constitution, and hilling the soil high round the plant bases. Recent experiments in soil fumigation with DDT have given encouraging results in combination with the use of varieties developed to produce more vigorous root generation.

LUCAS (G. B.). **A special method of isolating Thielavia basicola from Tobacco roots.**—Abs. in *Phytopathology*, xxxviii, 7, p. 571, 1948.

Thielavia basicola is frequently found on tobacco roots infected by the black root rot fungus *Thielaviopsis basicola* [see preceding abstract], but so far only one method has proved successful for its isolation. This consists in washing roots bearing perithecia of *Thielavia basicola* in tap water and incubating them at 37° C. on Richards's agar, using filter paper as a source of carbon instead of sucrose. A high percentage of the roots subjected to these conditions will yield the fungus.

HOLMES (F. O.). **Resistance to spotted wilt in Tomato.**—*Phytopathology*, xxxviii, 6, pp. 467–473, 1 fig., 1948.

During a study of dahlia plants affected with [tomato] spotted wilt [virus] in New Jersey during 1946 [*R.A.M.*, xxvii, pp. 299, 421] to determine the reason for the unprecedented spread of the disease to tomatoes, numerous spotted and distorted chickweed (*Stellaria media*) plants were found. Isolations from infected leaves yielded a virus similar to that isolated from ring spot lesions in dahlia when sub-inoculated to *Nicotiana glutinosa* and tomato. Moreover, the chickweed symp-

toms were reproduced readily by mechanical inoculation of healthy plants with the virus from dahlia.

The severity of the local outbreak can be attributed to extensive dahlia cultivation in an area heavily infested with chickweed. The seasons for the growth of both plants overlap and together cover the whole year. The spread of the disease among dahlias was checked by intensive cultivation to reduce the chickweed.

A new type of resistance to spotted wilt under New Jersey conditions was found in the Argentinian tomato varieties Rey de los Tempranos and Manzana (some lines only). It is inherited as a single Mendelian factor. In crosses with the susceptible Rutgers, approximately one quarter (102 out of 401) of the F_2 generation displayed resistance comparable to that of the resistant parent. Tests in Hawaii showed that the Argentine varieties were less resistant than Pearl Harbor.

Reichert (I.), Palti (J.), & Moeller (S.). **Spraying and dusting trials for Tomato disease control.**—*Palest. J. Bot.*, R. Ser., vi, 1–2, pp. 188–200, 1947.

The results are given of spraying and dusting trials carried out on Marmande tomatoes against *Oidiopsis taurica* [*R.A.M.*, xxvi, p. 174] and *Alternaria* leaf blight (species undetermined) [loc. cit.] in the Upper Galilee region of Palestine and against *Phytophthora infestans* [ibid., xxiv, p. 343] and *Alternaria* blight in the Inner Valleys (i.e., the eastern part of the Valley of Esdraelon, the Beisan Valley, and the northern Jordan Valley). In addition to these diseases, bacterial blight (*Xanthomonas vesicatoria*) [ibid., xxiv, p. 301; xxvii, pp. 313, 391] appeared in one trial. Five trials were carried out from 1942 to 1944 on summer- and autumn-grown tomatoes in the Upper Galilee, and four during the same period on autumn- and winter-grown crops in the Inner Valleys.

The results for powdery mildew have been noticed previously [ibid., xxvi, p. 175]. *Alternaria* and *P. infestans* on leaves and stalks and *Alternaria* fruit blight were satisfactorily controlled by copper treatments, especially Bordeaux mixture (0·75 per cent.) and perenox (0·25 per cent.). In the Inner Valleys these treatments increased yields to a total of 5·1 tons per dunum (1,000 sq. m.); in one instance control of *Alternaria* by these materials raised the yield by 1·2 tons per dunum and considerably improved fruit quality. Copper and sulphur treatments failed to reduce the incidence of *X. vesicatoria* on leaves and fruit. In one trial, weekly applications of floridan [ibid., xxvi, pp. 464, 478] reduced injury to tomato leaves by temperatures slightly above freezing. When the plants were adequately supplied with moisture, the addition of alboleum no. 1 oil or light-medium white oil to copper sprays did not affect the efficacy of the sprays or the resulting yield.

In the Upper Galilee, the control of *O. taurica* and *Alternaria* by the combined spersul-copper treatment increased yields by 13 to 33 per cent., while in a trial in which powdery mildew alone was present the figure was 36 to 49 per cent. The disease control in this area greatly extended the picking period.

Stoddard (E. M.) & Dimond (A. E.). **Influence of nutritional level on the susceptibility of Tomatoes to Fusarium wilt.**—*Phytopathology*, xxxviii, 8, pp. 670–671, 1 fig., 1948.

To produce tomatoes of maximum susceptibility to wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) for chemotherapeutic studies at the Connecticut Agricultural Experiment Station, plants of the susceptible John Baer variety were grown in builders' sand in unglazed pots. A complete nutrient solution, of the same composition as that used by Walker and Foster in their studies on plant nutrition in relation to disease development (0·1 H) [*R.A.M.*, xxv, p. 424], was added weekly at the rate of 25 ml. per pot, the rest of the moisture requirement being provided as water. Inoculated with a virulent strain of the fungus, such plants contracted the disease only very slowly, if at all, in contrast to the findings of the above-mentioned

workers [loc. cit.]. Obviously the nutritional level in the writers' tests was lower than the minimal examined by Walker and Foster, who found that at the optimum temperature for wilt, virulence decreased with an increase in nutrient concentration. Apparently, too, the plant responds to a decreased nutrient concentration below the minimal previously examined by an increased resistance to disease.

To verify this hypothesis, John Baer plants were grown in sand at a thermostatically controlled temperature of 83° F. and supplied on alternate days with 25 ml. of the above-mentioned nutrient solution at concentrations corresponding to Walker and Foster's 0·1 H, 1 H, and 10 H levels, the rest of the moisture requirement being given as water. However, since the nutrient solution in the authors' tests was not the sole source of moisture, the nutrition levels are lower than Walker and Foster's, and are here specified as 0·1 X, 1 X, and 10 X, respectively. Twenty plants were maintained at each level for a month before and a month after inoculation, when readings of disease were taken, based on (1) the number of plants infected, as judged by the appearance of vascular discoloration and wilted or dying leaves, and (2) the severity of disease expression, based on indices used by the above-mentioned workers. The numbers of infected plants at the three levels were 8 (40 per cent.), 19 (95), and 1 (5), respectively, and the severity indices 26, 75, and 0, respectively. Evidently, therefore, the optimum nutritional level for the infection of tomatoes by *F. b.* var. *lycopersici* and the severity of the resultant wilt lies between the minimum and the ideal for normal growth.

Mooi (J. C.). **Kanker en takinsterving van der Wilg veroorzaakt door Nectria galligena en Cryptodiaporthe salicina.** [Canker and branch die-back of the Willow caused by *Nectria galligena* and *Cryptodiaporthe salicina*.]—Thesis, Univ. [Amstersdam].—119 pp., 8 pl., 1 fig., 17 diags., 2 graphs, 1948. [English summary.]

Two willow (*Salix*) diseases occurring in various parts of Holland have been investigated and are here fully described and discussed in relation to the relevant literature, which is listed in a bibliography of 75 titles.

Numerous perennial cankers are formed by *Nectria galligena* on *S. alba* and its var. *calva* G. W. F. Mey. (syn. *coerulea* W. D. Koch), known as the cricket-bat willow, in the province of North Holland [cf. *R.A.M.*, xvii, p. 492]. The marginal tissues of the cankers, which bear the perithecia of the fungus, are killed, then a healing process occurs and the fresh tissues are once more attacked. This alternating sequence of dying and healing is repeated at intervals. The pathogen was isolated on cherry agar and successfully inoculated into *S. alba*, its var. *calva*, *S. amygdalina*, *S. viminalis*, and *S. purpurea*. On *S. amygdalina* in particular the symptoms were very virulent, the bark of the infected branch being killed over a distance of up to more than 10 dm. A callus is formed at the edge of the wound and gradually spreads over the dead tissues, but in some cases the lesion is not fully healed and in others the whole branch may be killed. No typical cankers, with proliferating and more or less irregular callus margins, develop either on *S. amygdalina* or on *S. viminalis* and *S. purpurea*, which also react to infection by the death of the bark over a length of 6 to 15 dm., the wounds sometimes closing and in other cases remaining open.

A study of the pathological anatomy of the disease in inoculated specimens showed that the initial stage of the canker resembles an anthracnose, in which the mycelium occurs in proximity to the dying cells. The cell contents are coagulated and turn dark brown. Another and more common type of reaction consists in the formation of a 'glassy' tissue, the cells of which are killed. These cells revealed no remains of a protoplast, nor was any mycelium found in their vicinity. The cell walls appear to be perforated, but the 'holes' are always due to areas where the wall is thin and between them are narrow strips of cell wall, which are locally

swollen and give wound gum reactions. This structural peculiarity of the cell wall has not previously been described as a feature of tissue destroyed by fungi.

A lateral branch stub very often protrudes from the centre of the canker; if not perceptible on the outside, it is almost invariably present internally. The cankers originate when the bark round the scars of thin lateral branch stubs has been killed by frost. *N. galligena* penetrates into this dead tissue and attacks the living. The tissues of the lateral branch scars and stubs were experimentally shown to be more susceptible than other parts of the bark to temperatures below 0° C.: in a test in November, 1947, they succumbed at −10°, while the remaining portions were undamaged. The foregoing mode of canker origin appears from a study of the literature to be also characteristic of other cankers [cf. ibid., xviii, p. 558], e.g., that of apple due to *N. galligena*, the perennial canker of the same host caused by *Gloeosporium* [*Neofabraea*] *perennans* [ibid., xxiv, p. 422], and larch canker [*Dasyscypha willkommii*: ibid., vii, p. 209]. The presence of lateral branch remnants in the centre seems likewise to be characteristic of many cankers besides that of *Salix* produced by *Nectria galligena* or other fungi.

Seasonal investigations of the periodical destruction of the canker tissue by *N. galligena* disclosed some important facts not hitherto reported. The suberization of the wound, which is annually attempted by the healing callus at the margin, is constantly prevented by renewed attacks in the autumn. These occur in two forms, one of which consists in the development of the above-mentioned 'glassy', mycelium-free tissue adjoining the most recently killed bark towards the centre of the lesion. It is assumed that toxic substances excreted by *N. galligena* kill the adjoining bark, which then becomes glassy. Later it turns brown and the mycelium penetrates it. During the winter the pathogen is more or less quiescent, resuming its attacks in the spring.

Another mode of reinfection involves the formation of 'separation layers' between the healthy and diseased tissue in the 'bark of the overgrowing callus wall'. The separated tissue presents a normal appearance and no mycelium could be detected in it, but after some time it dies off and at this stage mycelium is present. A remarkably similar process occurs every year in the older bark of *S. amygdalina*. It is thought that the toxins secreted by the fungus stimulate the development of separation layers to serve as barriers between the sound and infected areas. Once the tissue is dead it is penetrated by mycelium.

Strong indications were obtained that severe frost stimulated not only the inception but the development of canker in *S. alba* var. *calva* at Castricum, North Holland. When canker-bearing stems were placed in a refrigerator, the bark of the overgrowing tissue was found to be more susceptible than the normal to subzero temperatures. The prevalence of cankers on this species in 1940, 1941, and 1942 must be attributed to the hard frosts in these years. A description is given of the damage caused by frost on *S. alba* and its var. *calva* during the severe winters of 1941, 1942, and 1947 [cf. ibid., xiii, p. 484].

Inoculation experiments with *N. galligena* from willow gave positive results on apple [ibid., iii, p. 430] and poplar [cf. ibid., xiii, p. 480].

A full description is given of willow die-back, of which there is stated to be only one previous record in the literature relating to a milder form of the disease [ibid., ii, p. 93]. In the winter of 1941 many *S. alba* var. *calva* trees in South Holland were killed or injured by the die-back, which also severely attacked *S. alba* in some localities. The perithecia of *Cryptodiaporthe salicina* [cf. ibid., xix, p. 501] develop on dead twigs and branches, while the pycnidia of the imperfect state, *Discella carbonacea* [ibid., ii, p. 94], are even more abundant. The genetic connexion between the perfect and imperfect states was demonstrated by pure cultures, in which the pycnidia of *D. carbonacea* gave rise to the perithecia of *C. salicina* and vice versa.

Among other fungi commonly encountered on dead *Salix* branches is *Myxofusicoccum salicis* Died. f. *microspora* Died. (Kryptogamenflora der Mark Brandenburg, ix, p. 320, 1915), which caused anthracnose on *S. alba* and its var. *calva* in inoculation experiments and is presumed to have been responsible for the die-back of some twigs of the latter in the field in the spring of 1943. *M. salicis* f. *microspora* was further shown to be the agent of a brown leaf spot of both species of willow. This is stated to be the first record of the fungus as a parasite. The remaining organisms tested for pathogenicity, namely, *Valsa sordida* (*Cytospora chrysosperma*), *V. salicina*, *Physalospora miyabeana*, *Fusarium laterítium*, and *Gloeosporium* sp., proved to be of little or no importance in the etiology of the die-back.

Cricket-bat willows are commonly exposed to wind in Holland, and this is the probable reason for their susceptibility to damage by frost. Hence an important control measure against the die-back is the provision of shelter from the wind, which will also reduce the destruction of buds in the spring.

Miller (P. W.), Schuster (C. E.), & Stephenson (R. E.). **Diseases of the Walnuts in the Pacific Northwest.**—*Sta. Bull. Ore. agric. Exp. Sta.* 435, 42 pp., 29 figs., 1947.

In this bulletin (originally issued in 1945) practical notes intended for the assistance of growers are given on the causes, symptoms, and control of the chief diseases of walnuts in the Pacific Northwest. The most widespread and destructive is blight (*Xanthomonas juglandis*) [*R.A.M.*, xxvii, pp. 205, 590], control of which depends above all on the proper timing of the spray applications, especially in seedling orchards where each tree must be sprayed as it reaches the proper stage of development. The use of three instead of two pre-blossom sprays often gives better control, especially in rainy seasons. The severity of spray injury on very young leaves can be reduced by using a low-lime Bordeaux mixture (e.g., 4–2–100) plus a summer oil emulsion at the rate of 1 pint per 100 gals. in the first two applications. Dusting also will give commercial control.

Mushroom root rot (*Armillaria mellea*) [ibid., xiii, p. 552; xv, p. 763; xxv, p. 427 et passim], if noticed while the lesions are still small and localized, can sometimes be controlled by excision of the decayed areas and painting the wounds with Bordeaux mixture. The soil should be thrown back from the root crown and main roots in summer and replaced before winter. Hind's black walnut (*Juglans hindsii*) is more resistant than *J. regia* and trees propagated on the former should be planted in affected areas. During cultivation, care should be exercised to avoid wounding the base of the trunk and the main roots and walnut orchards should not be planted on newly cleared land where infected native oaks previously stood.

Crown gall (*Agrobacterium* [*Bacterium*] *tumefaciens*) [loc. cit.] sometimes responds to surgical methods. The efficacy of painting the galls with elgetol and methyl alcohol (20–80) is being tested [cf. ibid., xxi, p. 130].

Ring spot (*Ascochyta juglandis*) and downy leaf spot (*Microstroma juglandis*) [ibid., xxv, p. 427] are of minor economic importance locally and are seldom found in orchards sprayed regularly with Bordeaux mixture. Blotch, caused by *Gnomonia leptostyla* [ibid., xxvi, p. 186], attacks *J. nigra*, *J. hindsii*, and *J. regia*, and in the eastern United States also occurs on *J. cinerea*. It is rare on *J. regia* in the Pacific Northwest, having been recorded so far on this host only near Bellingham, Washington.

Boron deficiency [ibid., xxiv, p. 126] shows on the leaves as large, irregular, dark brown, intervenal spots, a condition referred to by growers as 'scorch'. In addition, elongated, leafless shoots are seen in the tops of the trees, and many nuts are shed when the size of large peas. The most effective control consists in broadcasting borax on the soil in February or early March at the rate of 3 lb. per tree for 12- to 14-year-old trees and 4 to 6 lb. for those 18 to 25 years. Boron toxicity

[ibid., xxi, p. 26] is indicated by the presence of brown marginal leaf spots, which develop without noticeable yellowing in advance. The dead spots later coalesce and lead to a general marginal necrosis which may spread towards the midrib, severely affected leaves usually falling prematurely. After an initial soil application of borax, no more should be applied unless only partial control of the deficiency has been attained, in which case half the amount originally used may be applied the next year.

Girdle or black line [ibid., xxi, p. 311], which has killed many grafted walnuts in Oregon in the past decade, various other non-parasitic disorders, and zinc deficiency are noted. The paper concludes with a general section on spray and dust materials and methods.

COLE (J. R.). **Results of eleven years' spraying for Pecan scab control with high-lime and low-lime Bordeaux mixture.**—*Phytopathology*, xxxviii, 7, pp. 552–555, 1948.

The results are presented of 11 years' spraying tests with 6–2–100 Bordeaux mixture, the same plus summer oil emulsion, and a 6–6–100 formula for pecan scab (*Cladosporium effusum*) control on 30-year-old trees of the very susceptible Schley variety in Georgia [*R.A.M.*, xix, p. 736; xxvii, p. 342], using only one spray gun to avoid injury to the foliage. Three schedules were compared, namely, (1) one application of 4–1–100 Bordeaux mixture followed by three treatments with 6–2–100; (2) as in (1), with the addition of summer oil emulsion (1 qt.–100); and (3) as in (1), substituting the 6–6–100 for the 6–2–100 formula.

The mean yields from trees sprayed with the high- and low-lime formulae did not differ appreciably, amounting to 50, 45, and 42 lb. per tree for treatments (1), (2), and (3), respectively, as against 18 lb. for the unsprayed. The 6–2–100 formula as in schedule (1) is recommended as being both more economical and slightly more effective than the 6–6–100. No spray or drought injury was observed on the treated trees, and the occurrence of such damage in the experiments of other workers [ibid., xiii, p. 812] may be attributable to the methods of application rather than to the materials used.

DEMAREE (J. B.) & LARGE (J. R.). **Leaf variegation in Tung.**—*Phytopathology*, xxxviii, 8, pp. 658–660, 1 fig., 1948.

A foliar variegation in tung (*Aleurites fordii*), consisting of an irregular pattern of three or four tones of green and yellow, was first observed in about 75 seedlings in a nursery near Cairo, Georgia, in 1930. Evidence is given that the variegation did not spread to healthy plants and was not transmissible by juice injections or tissue grafts. It affected 52·8 per cent. of the seedlings grown from seed from trees with variegated leaves. The condition is therefore considered to be of an hereditary character.

DROSDOFF (M.), SELL (H. M.), & GILBERT (S. G.). **Some effects of potassium deficiency on the nitrogen metabolism and oil synthesis in the Tung tree (Aleurites fordii).**—*Plant Physiol.*, xxii, 4, pp. 538–547, 1947.

At the University Station, Gainesville, Florida, the leaves of four-year-old potassium deficient tung trees (*Aleurites fordii*) [*R.A.M.*, xxiii, p. 462] were found to lose starch and polysaccharides later in the season to a greater extent than leaves of similar trees given 5 lb. potassium chloride or 3 lb. potassium nitrate. Fruit from these treated trees had a higher oil content than that from untreated ones, owing to a higher percentage of oil in the kernel and to a higher percentage of kernel. The low oil content and the accumulation of sucrose in kernels of potassium-deficient trees suggest that potassium may function in the process of conversion of sugar

into oil. Fruit from nitrogen-treated trees had a higher protein content and a higher percentage of kernel than that from untreated trees.

BAVENDAMM (W.). **Die pilzwidrige Wirkung der im Holzschutz benutzten Chemikalien.** [The anti-fungal action of the chemicals used in timber preservation.] —*Mitt. Reichsinst. Forst- u. Holzw., 1948*, 7, 14 pp., 1948. [English, French, and Spanish summaries.]

A tabulated survey is given of experiments covering a period of over three years to determine the relative efficiency against six, or in some cases seven, standard strains of wood-rotting fungi of 12 chemical preservatives, using the official German wood-block method DIN/DVM 2176 [*R.A.M.*, xxv, p. 376]. The resultant data necessitated a revision of the wood threshhold values of four out of the nine chemicals tested by Falck [ibid., vii, p. 292] against a single fungus, *Coniophora cerebella* [*C. puteana*], on unleached blocks.

The author rates as highly effective in the series of tests on unleached blocks sodium dinitro-ortho-cresol and mercuric chloride; effective are sodium fluoride, sodium arsenite, magnesium silico-fluoride, disodium arsenate, and zinc silico-fluoride; and of low efficiency sodium dinitrophenol, zinc chloride, potassium bichromate, coal tar oil, and copper sulphate. In the leached series high resistance to lixiviation was shown by mercuric chloride, sodium dinitro-ortho-cresol, and coal tar oil; slight resistance by potassium bichromate, zinc silico-fluoride, magnesium silico-fluoride, sodium arsenite, disodium arsenate, sodium dinitrophenol, and sodium fluoride; and very slight resistance by zinc chloride and copper sulphate. The efficacy of the arsenic salt, and more especially of sodium dinitrophenol, appears to have been over-rated up to the present.

Polyporus vaporarius [*Poria vaporaria*] was less vulnerable than *Lenzites abietina* to seven of the chemicals tested, while in the case of four others the positions were reversed. These two fungi should be supplemented by *Polystictus versicolor* and *C. puteana* in preservative efficiency tests, with the addition of *Lenzites squamosus* [*L. trabea*] for oily materials.

Plant quarantine import restrictions.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 166, pp. 49–69, 72–98, 1947.

Digests are furnished of the plant quarantine import restrictions operating in British Honduras, Bolivia, Cuba, Jamaica, Egypt, Mozambique, U.S.S.R., Nyasaland, Peru, Uruguay, Venezuela, and Morocco.

Distribution maps of plant diseases.—Maps 145–168. Issued by the Commonwealth Mycological Institute, 1948. 3*s.* 9*d.*

The seventh year's issue of this series of maps showing the world distribution of major crop diseases [*R.A.M.*, xxvii, p. 96] comprises (No. 145) *Bacterium rhapontici-cum* on rhubarb, (146) *Stachylidium theobromae* on banana, (147) tobacco leaf curl virus on tobacco, *Petunia*, and hollyhock, (148) *Polystigma rubrum* on plum, (149 *Didymascella thujina* on *Thuja plicata* and *T. occidentalis*, (150) *Tolyposporium penicillariae* on *Pennisetum typhoides*, (151) *Ascochyta rabiei* on chick pea (*Cicer arietinum*), (152) *Cercospora personata* on groundnut, (153) *Nematospora gossypii* on cotton, etc., (154) *Elsinoe theae* on tea, (155) *Deuterophoma tracheiphila* on *Citrus* spp., (156) *Corynebacterium rathayi* on rye, *Dactylis glomerata*, etc., (157) *Phytophthora megasperma* on hollyhock, potato, beet, etc., (158) *Gnomonia iliau* on sugar-cane, (159) *Colletotrichum linicola* on flax, (160) *Puccinia arachidis* on groundnut, (161) *Sphaceloma fawcettii* var. *scabiosa* on *Citrus* spp., (162) *Botrytis fabae* on broad bean, (163) *N. coryli* on cotton, etc., (164) *B. squamosa* on onion, (165) *B. byssoidea* on onion, (166) *Cercospora arachidicola* on groundnut, (167) *B. anthophila* on clover (*Trifolium* spp.), and (168) *Cordana musae* on banana.